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Curriculum Guide for INDUSTRIAL MECHANICS

MAY 1993

**State Division of Vocational Education
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May 10, 1993

Greetings:

The Division of Vocational Education is pleased to provide you with this State Curriculum Guide as a part of our commitment to your efforts in conducting quality educational programs for students who are preparing for employment in meaningful and rewarding occupations.

We know that a great deal of time and effort goes into the operation of a Vocational Education program, and we applaud your local efforts to make these programs available for students. This State Guide should assist you in these efforts.

The competency-based State Guide was developed from a Technical Committee Report prepared with the assistance of industry personnel. The Report includes a Task List which is the basis for the State Guide. The Tasks identified in the Technical Committee Report were representative of the competencies needed by a worker to be hired or employed in Idaho businesses.

Vocational Education has adopted the Competency-Based approach as the primary method of delivering Vocational Education skills to students. Competency Profiles are available for each student enrolled in programs as a means of recording student progress. The Profile is used as a student record when additional training is sought -- aiding in the program articulation process. The Profile also communicates to employers those skills the student has mastered.

We hope you find this document useful. Your comments are welcome!

A handwritten signature in black ink, appearing to read "Trudy Anderson". The signature is fluid and cursive, with a large initial "T" and "A".

**Trudy Anderson, Ph.D.
Administrator**

INTRODUCTION

The curriculum development process undertaken by the Idaho Division of Vocational Education involves the active use of industry personnel. Industry personnel comprise the sole membership on Technical Committees which are responsible for the development of Task Lists for each program. A Technical Committee Report is prepared on completion of the Committee's assignment. This publication is the Technical Committee Report.

The Task List prepared in the Technical Committee Report reflect the current trends and skills necessary for an employee to: 1) obtain a job in Idaho's industry, 2) retain a job once hired, and 3) to advance in the occupational field. Task Lists are grouped according to Duty areas generally used in industry settings. Duty areas are used as the basis for modules in the Statewide Curriculum Guide development process. The Technical Committee segment is the single most significant step in the curriculum development process. All future curriculum activities are predicated on the premise that an accurate picture of industry needs are reflected in the Task List.

Instructional personnel are selected to develop the Statewide Curriculum Guide. These instructors write Performance Objectives for each Task and the subsequent Enabling Objectives for each Performance Objective. The committee members prepare all material in a competency-based format so as to have an effective and efficient methodology for determining student progress. The Statewide Guides are designed as the prime determiner of program content. All programs must follow the established Guide in order to be approved for operation. Any deviation from this Guide requires written approval from the respective program supervisor at the Division of Vocational Education. It is not the intent of the Division that all programs be designed to be exactly the same, but assurance is needed to ensure that the program meets the minimum standards for operation, based on the community needs, equipment, and facilities available to the local school or institution.

The Technical Committee Report does not dictate the level of instruction. The Task List developed represents the entire occupational field. Schools and Institutions determine what skills can be taught and what depth of instruction can be provided. They must choose the Tasks to be taught from the Technical Committee Report but are free to determine how many or which ones can be incorporated into their program. Advisory committees are used in this step to reflect local industry training and employability trends.

The Technical Committee Report is also used as the primary list for generating Student Profiles. These Profiles are used as a cumulative record of each student's progress. They are printed in a folder format and have levels of performance scales for each Task so that student competence can be recorded for individual skills or tasks. This document will become the main component for Articulation activities in the event that the student desires to go on for additional training or education.

ACKNOWLEDGEMENTS

The Technical Committee process involves personnel from industry who are selected by the Division with assistance from the State Council on Vocational Education. People who serve on the Committees are nominated by local administrators. They generally come from local advisory committees for existing Vocational Education programs or are community and private sector representatives in a capacity to provide the necessary information about industry needs. These people serve with the approval of their employers and give their time and energies to the project without cost. The Division provides reimbursement for per diem and travel. We are indebted greatly to these industry representatives and to their employers for the resources so freely given to the pursuit of ensuring that Idaho students receive the most current training and education possible and that which is demanded by industry.

To this end, the Division recognizes the following people who served on the Technical Committee for Industrial Mechanics: Carl Hojem, Pinehurst; William H. Sparks, Heyburn; Rich Rabe, Boise; Dex Hendrickson, Rigby; Fred Brown, Lewiston; Larry Ridgeway, Pocatello; David Garcia, Paul; and Tom Jefferson, Spokane, Washington.

Your support and assistance was very greatly appreciated. Your patience for enduring the educational process is also noted. The students and instructional staff will be much more able to accomplish their respective goals as a result of your contributions.

The curriculum guide development process utilizes instructors selected from existing occupational programs to develop performance objectives and enabling objectives from the task list developed by the technical committee. The committee members selected to serve as writers for this guide were: Jim Cultra, Coeur d'Alene; Donald Mickalsky, Idaho Falls; Sean Phillips, Kellogg; Gary Milliser, St. Maries; Dave Aragon, Weippe; Bill Johnson, Caldwell; Lynn White, Lewiston; Bob Allen, Boise; Grant Ekstrom, Pocatello; and Brent Studer, Lewiston.

These contributions are greatly appreciated by the Division and the administrators of programs statewide.

**Sho Ueda, Supervisor
Trade and Technical Education**

**Don Eshelby, Ed.D.
Director of Program Services**

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CURRICULUM FRAMEWORK

PROGRAM AREA: Trade and Industrial

IDAHO DIVISION OF VOCATIONAL EDUCATION

REVISION DATE: May 1993

PROGRAM TITLE: INDUSTRIAL MECHANICS

IDAHO CODE NUMBER: 6109

CIP#47.0303

APPLICABLE LEVEL(S): 7-9 X 9-12

X Postsecondary Short-Term

X Postsecondary Vocational

-
- I. MAJOR CONCEPTS/CONTENT:** The purpose of this program is to prepare students for employment as millwrights (638.281-018), maintenance mechanics (629.280-010), machinery erectors (638.261-014), or to provide supplemental training for persons previously or currently employed in these occupations.

The content includes, but is not limited to, communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, welding skills, basic machine shop skills, metal working skills, troubleshooting skills, rigging skills, equipment installation skills, maintenance and repair skills for a variety of systems found in industrial operations including drive components, piping systems, pumps, hydraulic and pneumatic systems, electronic systems, and bearings and seals as well as skills in the set-up and operation of preventive maintenance programs.

- II. LABORATORY ACTIVITIES:** Shop or laboratory activities are an integral part of this program and provide instruction in shop practices, rigging, equipment installation, maintenance, troubleshooting and repair of drive systems, pumps, hydraulic and pneumatic systems as well as basic welding and machine shop skills.

- III. SPECIAL NOTE:** The Vocational Industrial Clubs of America, Inc., is an appropriate vocational student organization for providing leadership training experiences and reinforcing specific vocational skills. When provided, these activities are considered an integral part of this instructional program.

The cooperative method of instruction may be utilized for this program. Whenever the cooperative method is offered, the following is required for each student: a training plan, signed by the student, teacher and employer which includes instructional objectives and a list of on-the-job and in-school learning experiences; a work station which reflects equipment, skills, and tasks relevant to the occupation the student has chosen as a career goal. The student must receive compensation for work performed.

The typical length of this program for the average-achieving student at the post-secondary level is 1600 hours. The recommended length for secondary programs is 900 hours, with multi period blocks of instruction provided to accomplish a major portion of the listed competencies.

IV. INTENDED OUTCOMES: After successfully completing this program, the student will be able to:

- 01. Demonstrate employability skills and habits.**
- 02. Demonstrate knowledge of general safety precautions.**
- 03. Read blueprints.**
- 04. Demonstrate shop skills.**
- 05. Use and maintain hand tools.**
- 06. Use and maintain portable power tools.**
- 07. Use stationary shop equipment.**
- 08. Demonstrate troubleshooting skills.**
- 09. Perform gas welding/cutting.**
- 10. Perform arc welding/cutting.**
- 11. Demonstrate knowledge of electricity & electronics.**
- 12. Demonstrate knowledge of elements of mechanics.**
- 13. Demonstrate use and application of lubricants.**
- 14. Install and maintain drive components.**
- 15. Install, inspect, and repair or replace bearings.**
- 16. Perform pump maintenance and repair.**
- 17. Maintain piping systems and accessories.**
- 18. Maintain and repair hydraulic system components.**
- 19. Troubleshoot hydraulic systems.**
- 20. Explain the operation of reciprocating and rotary air compressors.**
- 21. Troubleshoot pneumatic systems.**
- 22. Explain the operation of industrial pollution control systems.**
- 23. Perform rigging functions.**
- 24. Explain equipment installation procedures.**
- 25. Perform machine shop turning operations.**
- 26. Perform machine shop milling operations.**
- 27. Analyze machine shop jobs.**
- 28. Demonstrate knowledge of maintenance management systems.**

INSTRUCTIONAL LEVEL CODE

NOTE: The letter key in the task listing is as follows:

Level

- | | |
|----------|--|
| E | Entry level skill - denotes basic instructional content necessary to enter job market. |
| R | Retention level skill - denotes instructional content needed to retain the job. |
| A | Advanced vocational education level skill - denotes skill training for retention and promotability. |

TASK LIST

The task list is a set of occupational skills or "tasks" which are grouped by modules. Each task describes an occupational activity that, when performed, will result in a finished process and can vary, but should always allow an evaluation using the standards which address the operation, appearance, dimensions, or similar characteristics.

The tasks in each module represent the fundamental activities that should be required of any student seeking institutional credit for performing at an acceptable level of competency. The tasks are sequenced to reflect a progression from the curriculum standards which are unique to an institution's instructional program and which should be added upon approval of the administration.

The capability for providing instructional experiences and practical application of the tasks contained in each module will determine the scope of the vocational-technical program. Primary considerations will obviously be the availability of equipment and the expertise of the instructional staff.

Individual records of student progress based on the task list should be developed or adapted by the vocational institution for use in recording the student's attainment of competency by task and module. Each task has a specific performance objective and a series of enabling objectives. The enabling objectives are steps in the procedure of attaining the knowledge and skill specified in the performance objective. Student's progress is measured by successful completion of the enabling objectives by oral, written or performance testing.

PROGRAM AREA: Trade & Industrial

PROGRAM TITLE: Industrial Mechanics

01.0 DEMONSTRATE EMPLOYABILITY SKILLS AND HABITS

The student will be able to:

LEVEL

- E 01.01 Identify employment opportunities.**
- E 01.02 Apply employment-seeking skills.**
- E 01.03 Interpret employment capabilities.**
- E 01.04 Demonstrate appropriate work behavior.**
- E 01.05 Maintain safe and healthy environment.**
- E 01.06 Maintain a business-like image.**
- E 01.07 Maintain working relationship with others.**
- E 01.08 Communicate on the job.**
- E 01.09 Adapt to change.**
- E 01.10 Demonstrate knowledge of business.**
- E 01.11 Perform mathematical skills.**
- E 01.12 Compile a portfolio.**

02.0 DEMONSTRATE KNOWLEDGE OF GENERAL SAFETY PRECAUTIONS

The student will be able to:

LEVEL

- E 02.01 Explain the purpose(s) of the OSHA Act.**
- E 02.02 Apply shop safety rules and procedures.**
- E 02.03 Apply personal safety rules and procedures.**
- E 02.04 Apply electrical safety rules and procedures.**
- E 02.05 Apply fire safety rules and procedures.**
- E 02.06 Apply hazardous wastes rules and procedures.**
- R 02.07 Demonstrate knowledge of emergency evacuation routes, master switch and lockout locations, and the safety color coding system for transport lines.**

03.0 READ BLUEPRINTS

The student will be able to:

LEVEL

- E 03.01 Explain the purpose of blueprints.**
- E 03.02 Explain and interpret machine parts and machine drawings.**
- E 03.03 Read machine assembly drawings.**
- R 03.04 Develop sketches.**
- R 03.05 Compute materials from blueprint drawings.**
- R 03.06 Interpret building drawings.**
- E 03.07 Read and interpret schematics and symbols.**
- E 03.08 Identify common features and differences of schematics.**
- E 03.09 Identify electrical wires and connections.**
- E 03.10 Read electrical diagrams.**
- E 03.11 Identify piping systems, projection, joints, valves, and symbols.**
- E 03.12 Read a piping schematic.**
- E 03.13 Identify fluid power system component symbols and interpret diagrams.**

- E 03.14 Interpret air conditioning and refrigeration system and subsystem schematics.
- E 03.15 Identify symbols for welds.

04.0 DEMONSTRATE SHOP SKILLS

The student will be able to:

LEVEL

- E 04.01 Add, subtract, multiply, and divide positive and negative numbers.
- E 04.02 Add, subtract, multiply, and divide fractions.
- E 04.03 Change mixed numbers to decimals.
- E 04.04 Compare numbers and calculate ratios.
- E 04.05 Demonstrate understanding of geometric functions.
- E 04.06 Solve algebraic equations.
- E 04.07 Explain the properties of triangles.
- E 04.08 Apply trigonometric functions to layout and installation situations.
- E 04.09 Demonstrate understanding of metric and linear measurement.
- E 04.10 Measure bulk materials.
- R 04.11 Use plumbing codes to determine materials.
- E 04.12 Explain techniques of measuring motion, forces, fluids, electricity, and temperature.
- E 04.13 Explain the mechanical and chemical properties of ferrous and non-ferrous metals.
- E 04.14 Explain industrial manufacturing processes.
- E 04.15 Explain the industrial use of non-metallic solids, liquids, and gases.
- E 04.16 Explain the precautions required when using toxic or flammable materials.
- E 04.17 Demonstrate use and maintenance of personal protective equipment.

05.0 USE AND MAINTAIN HAND TOOLS

The student will be able to:

LEVEL

- E 05.01 Demonstrate the use of rules, tapes, calipers, and micrometers.
- E 05.02 Demonstrate the use of wrenches and screwdrivers.
- E 05.03 Demonstrate the use and care of pipefitting tools.
- E 05.04 Demonstrate the use of line clearing equipment.
- E 05.05 Demonstrate the use of equipment used to bend and assemble rigid electrical conduit.
- E 05.06 Demonstrate the use and care of woodworking tools, including saws, planes, drills, hammers, nail sets, and marking gauges.
- E 05.07 Demonstrate the use and care of sheet metal tools, including sheet metal gauges, layout tools, dividers, punches, nibblers, riveting tools, metal cutting chisels, metal cutting snips, forming tools, hand seamers, and soldering irons.
- E 05.08 Demonstrate proper metalworking bench skills, including the use of vices, hacksaws, files, tapes, dies, and reamers.
- E 05.09 Demonstrate the use and care of ropes, slings, pulleys, and block and tackle.
- E 05.10 Demonstrate the use and care of test and safety equipment.

06.0 USE AND MAINTAIN PORTABLE POWER TOOLS

The student will be able to:

LEVEL

- E 06.01 Demonstrate the use and maintenance of light-duty and heavy-duty drills.**
- E 06.02 Demonstrate the use and maintenance of electric hammers.**
- E 06.03 Demonstrate the use and maintenance of pneumatic drills and hammers.**
- E 06.04 Demonstrate the use and maintenance of power screwdrivers and impact wrenches.**
- E 06.05 Demonstrate the use and maintenance of linear motion saws.**
- E 06.06 Demonstrate the use and maintenance of circular saws.**
- E 06.07 Demonstrate the use and maintenance of routers and planes.**
- E 06.08 Demonstrate the use and maintenance of belt, pad and disc sanders.**
- E 06.09 Demonstrate the use and maintenance of grinders and shears.**
- A 06.10 Demonstrate the use and maintenance of explosive actuated tools.**
- E 06.11 Sharpen tools using a bench grinder.**

07.0 USE STATIONARY SHOP EQUIPMENT

The student will be able to:

LEVEL

- E 07.01 Demonstrate the use of mechanical presses.**
- E 07.02 Demonstrate the use of hydraulic presses.**
- E 07.03 Demonstrate the use of drill presses.**
- E 07.04 Demonstrate the use of bench grinders.**
- E 07.05 Demonstrate the use of power hack saws, cut-off saws or chop saws.**
- E 07.06 Demonstrate the use of band saws.**
- E 07.07 Demonstrate the use of pipe threaders.**
- E 07.08 Demonstrate the use of power metal brakes.**
- E 07.09 Demonstrate the use of power shears.**

08.0 DEMONSTRATE TROUBLESHOOTING SKILLS

The student will be able to:

LEVEL

- E 08.01 Explain the importance of maintenance.**
- E 08.02 Explain and demonstrate troubleshooting procedures.**
- E 08.03 Identify aids to troubleshooting.**
- E 08.04 Demonstrate knowledge of the safety rules for troubleshooting and repair procedures.**
- R 08.05 Maintain troubleshooting and repair records.**
- E 08.06 Use manufacturer's manuals, schematics, and troubleshooting charts, as well as general machinery manuals and references.**

09.0 PERFORM GAS WELDING/CUTTING

The student will be able to:

LEVEL

- E 09.01 Identify gas welding and cutting equipment and accessories.**
- E 09.02 Identify personal protective equipment required for welding and cutting.**
- E 09.03 Explain capillary attraction as it applies to metal joining.**
- E 09.04 Demonstrate proper lighting, adjusting, and shutting down of a gas torch.**
- E 09.05 Layout and cut mild steel.**
- E 09.06 Braze mild steel.**
- E 09.07 Braze cast iron.**
- E 09.08 Solder non-ferrous metals.**

10.0 PERFORM ARC WELDING/CUTTING

The student will be able to:

LEVEL

- E 10.01 Set up and adjust a shielded metal arc welder.
- E 10.02 Identify and select electrodes.
- E 10.03 Strike, maintain and restart an S.M.A.W. arc.
- E 10.04 Weld straight bead in flat position.
- E 10.05 Weld weave bead patterns.
- E 10.06 Weld build-up pads.
- E 10.07 Weld basic joints in flat position (1G and 1F).
- E 10.08 Weld basic joints in horizontal position (2G and 2F).
- E 10.09 Weld basic joints in vertical position (3G and 3F).
- E 10.10 Weld basic joints in overhead position (4G and 4F).
- E 10.11 Weld cast iron.
- E 10.12 Weld alloy steels.
- E 10.13 Build up shaft or round surface.
- E 10.14 Weld aluminum.
- E 10.15 Hard surface metals with S.M.A.W.
- E 10.16 Set up a gas tungsten arc welder.
- E 10.17 Select and prepare a tungsten electrode.
- E 10.18 Strike and maintain a G.T.A.W. arc.
- E 10.19 Weld mild steel in all positions (1F thru 4F).
- E 10.20 Weld stainless steel in all positions (1G thru 4G).
- E 10.21 Weld aluminum in all positions (1G thru 4G).
- E 10.22 Set up and adjust G.M.A.W. and F.C.A.W.
- E 10.23 Weld weave bead patterns using G.M.A.W. and F.C.A.W.
- E 10.24 Weld basic joints in flat, horizontal, and vertical positions.
- E 10.25 Set up air carbon arc cutting equipment.
- E 10.26 Gouge, cut and pierce metals using air carbon arc.

11.0 DEMONSTRATE KNOWLEDGE OF ELECTRICITY & ELECTRONICS

The student will be able to:

LEVEL

- E 11.01 Define common terms used in electricity and electronics.
- E 11.02 Discuss the National Electrical Code.
- E 11.03 Explain the nature of static electricity.
- E 11.04 Explain methods used to measure and control static electricity.
- E 11.05 Explain the theory of magnetism.
- E 11.06 Describe the industrial uses of magnets and electromagnets.
- E 11.07 Explain the purpose and use of transformers.
- E 11.08 Explain Ohm's Law.
- E 11.09 Use instruments which measure current, resistance, and potential difference.
- E 11.10 Explain the fundamentals of DC circuits.
- E 11.11 Explain the use of DC circuits in motors and generators.
- E 11.12 Explain the use and function of electrical and electronic control equipment.
- E 11.13 Discuss programmable controllers.
- E 11.14 Explain the differences between AC and DC circuits.
- E 11.15 Demonstrate knowledge of the instruments used to measure electrical circuits.
- E 11.16 Measure load in three phase circuits.
- E 11.17 Install electric motors.

- E 11.18 Demonstrate knowledge of troubleshooting procedures for electric circuits and control systems.
- E 11.19 Troubleshoot DC motors.
- E 11.20 Troubleshoot AC motors.
- E 11.21 Troubleshoot lighting systems.

12.0 DEMONSTRATE KNOWLEDGE OF THE ELEMENTS OF MECHANICS

The student will be able to:

LEVEL

- E 12.01 Demonstrate an understanding of measuring systems and ratios.
- E 12.02 Explain working forces of torque, tension, and compression.
- E 12.03 Explain the laws of motion.
- E 12.04 Explain how to calculate work.
- E 12.05 Explain the function of simple machines including levers, inclined plane, wedge wheel and axle, pulley and screw.
- E 12.06 Explain the types of power and the method of producing power including compound gears.
- E 12.07 Calculate volume mathematically and by displacement.
- E 12.08 Explain the laws of friction.

13.0 DEMONSTRATE THE USE AND APPLICATION OF LUBRICANTS

The student will be able to:

LEVEL

- E 13.01 Explain the function of lubricants.
- E 13.02 Explain the properties of oil lubricants and factors determining the selection of lubricants.
- E 13.03 Identify the types and functions of lubricant additives.
- E 13.04 Describe the types of circulating oils and their purposes.
- R 13.05 Describe lubricating systems, including the charts and methods used.
- E 13.06 Demonstrate proper grease application.
- E 13.07 Demonstrate proper lubricant storage and handling.
- E 13.08 Lubricate a piece of industrial equipment.

14.0 INSTALL AND MAINTAIN DRIVE COMPONENTS

The student will be able to:

LEVEL

- E 14.01 Install a solid coupling.
- E 14.02 Install a jaw coupling.
- E 14.03 Install a molded rubber coupling.
- E 14.04 Install a chain type coupling.
- E 14.05 Identify and install a clutch.
- E 14.06 Install V-belts and adjust tension.
- E 14.07 Install and adjust a V-belt and manually adjustable sheaves.
- E 14.08 Install a V-belt with spring loaded adjustable sheaves.
- E 14.09 Describe and explain the purposes and advantages of a chain drive system.
- E 14.10 Explain the function of speed reducers.
- E 14.11 Explain the function of gears and variable speed reducers.
- E 14.12 Install and align shafts.
- E 14.13 Mount drive sprockets and chains.
- E 14.14 Mount sheaves and pulleys.
- E 14.15 Mount and align gears on open gear drives.

- E 14.16 Install a mechanical clutch system.
- E 14.17 Install adjustable speed drives.
- E 14.18 Troubleshoot adjustable speed drives.
- E 14.19 Explain the operation of fluid couplings.
- E 14.20 Install fluid couplings.
- E 14.21 Install torque converters.
- E 14.22 Perform preventive maintenance on drive components.

15.0 INSTALL, INSPECT, AND REPAIR OR REPLACE BEARINGS

The student will be able to:

LEVEL

- E 15.01 Identify common bearing types and their advantages.
- E 15.02 Mount, square, and align anti-friction bearings.
- E 15.03 Identify specialized bearings, their applications and characteristics, including: thrust bearings, self-aligning bearings, non-metallic bearings, and hydrostatic bearings.
- E 15.04 Identify and select bearing seals for specified applications.
- E 15.05 List rules for good bearing lubrication.
- E 15.06 Explain bearing load, wear patterns, & maintenance.
- E 15.07 Explain the use of cross-reference manuals in bearing maintenance and repair.
- E 15.08 Explain the use of bearing forecast maintenance systems.
- E 15.09 Remove, inspect, and replace a plain journal bearing.

16.0 PERFORM PUMP MAINTENANCE AND REPAIR

The student will be able to:

LEVEL

- R 16.01 Determine pump capacity and system requirements.
- E 16.02 Identify packing and seal requirements.
- E 16.03 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating and metering pumps.
- E 16.04 Disassemble and reassemble a pump.
- E 16.05 Perform pump maintenance.

17.0 MAINTAIN PIPING SYSTEMS AND ACCESSORIES

The student will be able to:

LEVEL

- E 17.01 Identify the components of a piping system.
- E 17.02 Explain the maintenance features of both metallic and non-metallic piping systems.
- E 17.03 Explain valve operation and maintenance.
- E 17.04 Explain the use and maintenance of strainers, filters, and traps in piping systems.
- E 17.05 Bend and join copper tubing.
- E 17.06 Bend and join steel tubing.
- E 17.07 Join common fittings.
- E 17.08 Join metallic pipe.
- E 17.09 Join plastic pipe.

18.0 MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS

The student will be able to:

LEVEL

- E 18.01 Explain Pascal's Law.**
- E 18.02 Explain Bernoulli's Principle.**
- E 18.03 Explain how heat and pressure relate to power and transmission.**
- E 18.04 Describe the physical and chemical properties of a fluid.**
- E 18.05 Install and maintain a contaminant removal system.**
- E 18.06 Explain the operation and use of heat exchangers.**
- E 18.07 Determine reservoir requirements.**
- E 18.08 Classify and select pumps for specific applications.**
- E 18.09 Compute hose requirements.**
- E 18.10 Install hydraulic lines.**
- R 18.11 Select and install control valves and servo-type valves.**

19.0 TROUBLESHOOT HYDRAULIC SYSTEMS

The student will be able to:

LEVEL

- E 19.01 Read a hydraulic schematic.**
- E 19.02 Connect electrically controlled valves.**
- E 19.03 Explain hydraulic system troubleshooting techniques.**
- E 19.04 Repair and replace hydraulic valves.**
- E 19.05 Repair and replace hydraulic cylinders.**
- E 19.06 Repair and replace hydraulic pumps and motors.**
- E 19.07 Cut, flare, and bend hydraulic tubing.**
- E 19.08 Install hydraulic components.**

20.0 EXPLAIN RECIPROCATING AND ROTARY AIR COMPRESSORS

The student will be able to:

LEVEL

- E 20.01 Explain the relationship of force, weight, mass, and density in a pneumatic system.**
- E 20.02 Explain the operation of reciprocating compressors.**
- E 20.03 Explain the operation of rotary compressors.**
- E 20.04 Explain primary and secondary air treatment.**
- E 20.05 Explain the operation of compressor valves, cylinders, and motors.**

21.0 TROUBLESHOOT PNEUMATIC SYSTEMS

The student will be able to:

LEVEL

- E 21.01 Identify the schematic symbols and diagrams used in pneumatic systems.**
- E 21.02 Diagram an air supply system.**
- E 21.03 Install pneumatic system components.**
- E 21.04 Explain pneumatic system maintenance techniques.**
- E 21.05 Explain pneumatic system troubleshooting procedures.**
- E 21.06 Troubleshoot air compressors.**
- E 21.07 Troubleshoot pneumatic control valves.**
- E 21.08 Troubleshoot, repair, and install control valves.**
- E 21.09 Troubleshoot air motors.**
- E 21.10 Troubleshoot air dryers.**

22.0 EXPLAIN THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYSTEMS

The student will be able to:

LEVEL

- E 22.01 Explain the operation of air pollution control systems.**
- E 22.02 Explain the operation of water pollution control systems.**
- E 22.03 Explain the operation of solid waste pollution control systems.**
- E 22.04 Explain the operation of noise pollution control systems.**
- E 22.05 Explain the basic philosophy of "right to know" legislation.**

23.0 PERFORM RIGGING FUNCTIONS

The student will be able to:

LEVEL

- E 23.01 Estimate the weight of a load.**
- E 23.02 Find the center of gravity.**
- E 23.03 Identify the rigging and slings used in maintenance work.**
- E 23.04 Explain safety inspection procedures for rigging, ropes, and slings.**
- E 23.05 Identify rope fiber types.**
- E 23.06 Tie rigging knots, bends, and hitches.**
- E 23.07 Identify types of wire rope.**
- E 23.08 Cut and seize wire rope.**
- E 23.09 Install wire rope eyes, sockets, and hooks.**
- E 23.10 Identify cranes and hoists.**
- E 23.11 Splice wire rope.**
- E 23.12 Erect a scaffold and install planking.**
- E 23.13 Raise a ladder.**
- E 23.14 Rig lifebelts and life nets.**

24.0 INSTALL EQUIPMENT

The student will be able to:

LEVEL

- E 24.01 Explain relocation procedures for new equipment in an existing facility.**
- E 24.02 Explain the use of anchors and isolators.**
- E 23.03 Explain procedures for moving and installing new equipment.**
- E 24.04 Explain leveling and aligning procedures.**
- E 24.05 Explain test run guidelines.**
- E 24.06 Explain safety precautions for equipment installation procedures.**
- E 24.07 Explain grouting procedures.**

25.0 PERFORM MACHINE SHOP TURNING OPERATIONS

The student will be able to:

LEVEL

- E 25.01 Identify the principal parts of an engine lathe.**
- E 25.02 Demonstrate the safe and proper use of lathes and attachments.**
- E 25.03 Perform turning operations.**
- E 25.04 Perform boring operations.**
- E 25.05 Perform drilling and reaming operations.**
- E 25.06 Perform internal and external threading operations.**

26.0 PERFORM MACHINE SHOP MILLING OPERATIONS

The student will be able to:

LEVEL

- E 26.01 Identify types of milling machines and tooling.
- E 26.02 Determine spindle speed, feed rates, and direction of feed.
- E 26.03 Perform external milling operations.
- E 26.04 Perform angular milling operations.
- E 26.05 Perform internal milling operations.
- E 26.06 Slab mill a work piece.
- E 26.07 Slot on a horizontal milling machine.
- E 26.08 Mill a keyway.

27.0 ANALYZE MACHINE SHOP JOBS

The student will be able to:

LEVEL

- E 27.01 Determine sequence of work on a specified project.
- E 27.02 Determine tolerances and finishes.
- E 27.03 Explain the variables that affect job efficiency.
- E 27.04 Explain the use of the Machinery Handbook.

28.0 DEMONSTRATE KNOWLEDGE OF MAINTENANCE MANAGEMENT SYSTEMS

The student will be able to:

LEVEL

- E 28.01 Demonstrate knowledge of manual record keeping practices.
- E 28.02 Demonstrate knowledge of electronic record keeping practices.
- E 28.03 Complete a work order.
- E 28.04 Complete an internal requisition.
- E 28.05 Complete an external requisition.
- E 28.06 Use a microfiche record system.
- E 28.07 Define and explain scheduled maintenance.
- E 28.08 Define and explain planned maintenance.
- E 28.09 Define and explain breakdown maintenance.
- E 28.10 Explain the reasons for keeping maintenance records.
- E 28.11 Explain the reasons for keeping cost records.
- E 28.12 Demonstrate basic computer literacy.
- E 28.13 Define statistical process control (SPC).

Employability skills are a vital component of vocational education programs and should be incorporated into each occupational task list.

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

**MODULE I
EMPLOYABILITY SKILLS AND HABITS**

MODULE I - EMPLOYABILITY SKILLS AND HABITS

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It is the goal of this program guide to provide a level of instruction which will impart entry level employment skills. Students should be carefully counseled on the importance of attaining competency in the tasks assigned. As in virtually all occupations today, industrial mechanics will require periodic up-dating and review in the future. It is important that each student understand that meeting the program standards is essential not only to obtain employment today but also to have a base upon which to retain employment in the future.

IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 1 - EMPLOYABILITY SKILLS AND HABITS

The student will be able to:

LEVEL

- | | |
|----------|---|
| E | 01.01 Identify employment opportunities |
| E | 01.02 Apply employment-seeking skills. |
| E | 01.03 Interpret employment capabilities. |
| E | 01.04 Demonstrate appropriate work behavior. |
| E | 01.05 Maintain safe and healthy environment. |
| E | 01.06 Maintain a business-like image. |
| E | 01.07 Maintain working relationship with others. |
| E | 01.08 Communicate on the job. |
| E | 01.09 Adapt to change. |
| E | 01.10 Demonstrate knowledge of business. |
| E | 01.11 Perform mathematical skills. |
| E | 01.12 Compile a portfolio. |

EMPLOYABILITY SKILLS AND HABITS

01.01 TASK: IDENTIFY EMPLOYMENT OPPORTUNITIES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given the information resources of a library, obtain and compile the information needed to seek a job.

ENABLING OBJECTIVES:

1. **Identify the requirements for a job/job description.**
2. **Investigate educational opportunities.**
3. **Investigate occupational opportunities.**
4. **Locate resources for finding employment.**
5. **Confer with prospective employers.**
6. **Identify job trends.**
7. **Research geographic locations.**

01.02 TASK: APPLY EMPLOYMENT-SEEKING SKILLS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate information, locate a job opportunity, prepare and take an interview for it, complete the required tests, forms and applications, and evaluate the job opportunity.

ENABLING OBJECTIVES:

1. **Locate a job opening.**
2. **Complete a resume.**
3. **Prepare for an interview.**
4. **Participate in an interview.**
5. **Complete tests required.**
6. **Complete forms required.**
7. **Complete an application letter.**
8. **Complete a follow-up letter.**
9. **Complete an acceptance letter.**
10. **Evaluate a job offer.**
11. **Evaluate a job rejection.**

01.03 TASK: INTERPRET EMPLOYMENT CAPABILITIES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given the assignment to explain how your capabilities make you employable, demonstrate how to match skills and experience to a job.

ENABLING OBJECTIVES:

1. **Match personal interest to job area.**
2. **Match personal aptitudes to job area.**
3. **Verify personal abilities.**
4. **Identify an immediate work goal.**
5. **Develop a career plan.**

1.04 TASK: DEMONSTRATE APPROPRIATE WORK BEHAVIOR.

LEVEL E PERFORMANCE OBJECTIVE: Given the responsibility of an employee in a new job, demonstrate knowledge of appropriate behavior in the work place.

ENABLING OBJECTIVES:

1. Exhibit dependability.
2. Demonstrate punctuality.
3. Follow rules and regulations.
4. Explain the consequences of dishonesty.
5. Complete assignments accurately and on time.
6. Control personal emotions.
7. Show responsibility for decisions and actions
8. Show pride in work and be a loyal worker.
9. Adapt to pressures and tensions.
10. Demonstrate ability to set priorities.
11. Demonstrate problem-solving skills.

01.05 TASK: MAINTAIN SAFE AND HEALTHY ENVIRONMENT.

LEVEL E PERFORMANCE OBJECTIVE: Given the responsibility of an employee in a new job, demonstrate knowledge of safety in the workplace.

ENABLING OBJECTIVES:

1. Comply with safety and health rules.
2. Select correct tools and equipment.
3. Utilize equipment correctly.
4. Use appropriate action during emergencies.
5. Maintain clean and orderly work area.
6. Demonstrate personal hygiene and cleanliness.
7. Identify and locate Material Safety Data Sheets (MSDS).

01.06 TASK: MAINTAIN A BUSINESS-LIKE IMAGE.

LEVEL E PERFORMANCE OBJECTIVE: Given a responsibility to perform the duties of a new job, with a new employer, demonstrate knowledge of the attitudes and behaviors which will project a business-like image.

ENABLING OBJECTIVES:

1. Participate in company or agency orientation.
2. Demonstrate knowledge of company or agency products and services.
3. Exhibit positive behavior.
4. Read current job-related publications.
5. Support and promote employer's company image and purpose.
6. Maintain appearance to comply with company standards.

01.07 TASK: MAINTAIN WORKING RELATIONSHIPS WITH OTHERS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given the responsibility to perform the duties of a new job, with a new employer, demonstrate knowledge of how to successfully work with others.

ENABLING OBJECTIVES:

1. **Work productively with others.**
2. **Show empathy, respect and support for others.**
3. **Demonstrate procedures and assist others when necessary.**
4. **Recognize problems and work toward their solution.**
5. **Minimize the occurrence of problems.**
6. **Channel emotional reactions in positive ways.**

01.08 TASK: COMMUNICATE ON THE JOB.

LEVEL E **PERFORMANCE OBJECTIVE:** Given the responsibility to perform the duties of a new job, with a new employer, demonstrate knowledge of how to successfully communicate with others.

ENABLING OBJECTIVES:

1. **Read and comprehend written communications and information.**
2. **Use correct grammar.**
3. **Speak clearly with others.**
4. **Use job-related terminology.**
5. **Listen attentively.**
6. **Write legibly.**
7. **Use telephone etiquette.**
8. **Follow written and oral directions.**
9. **Ask questions.**
10. **Locate information in order to accomplish task.**
11. **Prepare written communication.**
12. **Utilize keyboarding skills.**
13. **Utilize computer skills.**

01.09 TASK: ADAPT TO CHANGE.

LEVEL E **PERFORMANCE OBJECTIVE:** Given the responsibility to perform the duties of a new job, with a new employer, demonstrate knowledge of how to adapt to change.

ENABLING OBJECTIVES:

1. **Recognize the need to change.**
2. **Demonstrate a willingness to learn.**
3. **Demonstrate flexibility.**
4. **Participate in continuing education.**
5. **Seek challenge in the work place.**
6. **Adjust goals and plans when necessary.**

01.10 TASK: DEMONSTRATE KNOWLEDGE OF BUSINESS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given the responsibility to perform the duties of a new job, with a new employer, demonstrate knowledge of the role of that business, its employees, and the free enterprise system.

ENABLING OBJECTIVES:

1. Explain the role of business in the free enterprise system.
2. List the responsibilities of employees.
3. Identify the responsibilities of managers and employers.
4. Discuss the opportunities for business ownership or management.
5. Describe the planning required to start a business.
6. Discuss the importance of business meetings.

01.11 TASK: PERFORM MATHEMATICAL CALCULATIONS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given mathematics problems associated with industrial maintenance applications, solve accurately within a specified time period.

ENABLING OBJECTIVES:

1. Add and subtract whole numbers, decimals and fractions.
2. Multiply and divide whole numbers, decimals and fractions.
3. Convert numbers between forms expressed as fractions, decimals and percents.
4. Convert between standard American units of measure.
5. Convert between standard American units and metric units.
6. Apply descriptive geometry skills to industrial maintenance practices.

01.12 TASK: COMPILE A PORTFOLIO.

LEVEL E **PERFORMANCE OBJECTIVES:** Given examples of portfolios and instruction on developing portfolios, compile and organize a portfolio of personal drawings and information for presentation.

ENABLING OBJECTIVES:

1. Define portfolio.
2. Explain the purpose of a portfolio.
3. List procedures for compiling and organizing a portfolio.
4. Demonstrate the ability to develop a portfolio.
5. Demonstrate the ability to present a portfolio.

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

**MODULE 2
GENERAL SAFETY PRECAUTIONS**

MODULE 2 - DEMONSTRATE KNOWLEDGE OF GENERAL SAFETY PRECAUTIONS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 2 - GENERAL SAFETY PRECAUTIONS

The student will be able to:

LEVEL

- | | |
|----------|---|
| E | 02.01 Explain the purposes of the OSHA Act. |
| E | 02.02 Explain shop safety rules and procedures. |
| E | 02.03 Explain personal safety rules and procedures. |
| E | 02.04 Explain electrical safety rules and procedures. |
| E | 02.05 Explain fire safety rules and procedures. |
| E | 02.06 Explain hazardous wastes rules and procedures. |
| R | 02.07 Demonstrate knowledge of emergency evacuation routes, master switch and lockout locations, and the safety color coding system for transport lines. |

GENERAL SAFETY PRECAUTIONS

02.01 TASK: EXPLAIN THE PURPOSE(S) OF THE OSHA ACT.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate classroom instruction, government manuals and guides, define OSHA and explain its purpose(s).

ENABLING OBJECTIVES:

1. **Define OSHA.**
2. **Describe the government's responsibilities under OSHA.**
3. **Describe the employer's responsibilities under OSHA.**
4. **Describe the employee's responsibilities under OSHA.**

02.02 TASK: EXPLAIN SHOP SAFETY RULES AND PROCEDURES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate classroom instruction, specific rules and instruction on shop safety, and necessary manuals and guides, explain the rules and procedures for each given situation.

ENABLING OBJECTIVES:

1. **Describe the sources for shop safety rules and procedures.**
2. **Discuss when safety rules and procedures should be read.**
3. **Discuss what to do when safety rules and procedures are not available.**
4. **Discuss the importance of observing safety rules and procedures to job security.**

02.03 TASK: EXPLAIN PERSONAL SAFETY RULES AND PROCEDURES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate classroom instruction, specific rules and instructions on personal safety, and necessary manuals and guides, explain the rules and procedures for each given situation.

ENABLING OBJECTIVES:

1. **Identify the documents containing personal safety rules and procedures.**
2. **Discuss each individual's responsibility for knowing and following personal safety procedures.**
3. **Discuss personal safety when starting a new job or procedure.**

02.04 TASK: EXPLAIN ELECTRICAL SAFETY RULES AND PROCEDURES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate classroom instruction, specific codes and guidelines on electrical safety, and rules and procedures for operations involving electric equipment or operations, explain the rules and procedures for each given situation.

ENABLING OBJECTIVES:

1. Identify the sources of electrical safety rules and procedures.
2. Describe basic precautions observed when working with electric tools or electric power sources.
3. Describe the proper use of non-conducting protective equipment.
4. Discuss the importance of knowing the location circuit breakers and power switches.
5. Describe the steps in giving first aid to an electric shock victim.

02.05 TASK: EXPLAIN FIRE SAFETY RULES AND PROCEDURES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate classroom instruction on fire prevention in the workplace, explain rules and procedures for each given situation.

ENABLING OBJECTIVES:

1. Identify the sources of fire safety rules and procedures.
2. Describe basic precautions to prevent fires in the workplace.
3. Describe the proper use of shop fire suppression equipment.
4. Discuss the importance of knowing emergency evacuation routes from the workplace.
5. Describe the steps in giving first aid to a burn victim.

02.06 TASK: EXPLAIN HAZARDOUS WASTE RULES AND PROCEDURES.

LEVEL E **PERFORMANCE OBJECTIVE:** Given appropriate classroom instruction, specific codes and guidelines on hazardous wastes, and rules and procedures for handling hazardous wastes in the workplace, explain the rules and procedures for each given situation.

ENABLING OBJECTIVES:

1. Identify the sources of hazardous waste handling rules and procedures.
2. Describe the basic precautions to be taken when handling any toxic or hazardous material.
3. Discuss the proper use of hazardous waste receptacles.
4. Discuss the proper use of protective clothing and equipment when handling hazardous materials.
5. Describe the steps to be taken when an accident involving hazardous wastes occurs.

02.07 TASK: DEMONSTRATE KNOWLEDGE OF EMERGENCY EVACUATION ROUTES, MASTER SWITCH AND LOCKOUT LOCATIONS, AND THE SAFETY COLOR CODING SYSTEM FOR TRANSPORT LINES.

LEVEL R PERFORMANCE OBJECTIVE: Given appropriate maps, schematics, and instructions, applying to a specific shop site, demonstrate knowledge of emergency evacuation route, master switch and lockout locations, and the color coding of transport lines within that shop.

ENABLING OBJECTIVES:

- 1. Explain the routing on the evacuation map for the shop.**
- 2. Identify the master switch and lockout location(s) on a schematic of the shop.**
- 3. Identify the types of transport lines on a color coded schematic of the shop.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

**MODULE 3
BLUEPRINT READING**

MODULE III - BLUEPRINT READING

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 3 - BLUEPRINT READING

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 03.01 | Explain the purpose of blueprints. |
| E | 03.02 | Explain and interpret machine parts and copies of machine drawings. |
| E | 03.03 | Read machine assembly drawings. |
| E | 03.04 | Develop sketches. |
| R | 03.05 | Compute materials from blueprint drawings. |
| R | 03.06 | Interpret building drawings. |
| E | 03.07 | Read and interpret schematics and symbols. |
| E | 03.08 | Identify common features and differences of schematics. |
| E | 03.09 | Identify electrical wires and connections. |
| E | 03.10 | Read electrical diagrams. |
| E | 03.11 | Identify piping systems, projections, joints, values and symbols. |
| E | 03.12 | Read a piping schematic. |
| E | 03.13 | Identify fluid power system component symbols and interpret diagrams. |
| E | 03.14 | Interpret air conditioning and refrigeration system and subsystem schematics. |
| E | 03.15 | Identify symbols for welds. |

BLUEPRINT READING

03.01 TASK: EXPLAIN THE PURPOSE OF BLUEPRINTS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, study materials, and blueprints, explain the purpose of blueprints.

ENABLING OBJECTIVES:

1. **Discuss the need for accuracy in machine maintenance.**
2. **Explain the purpose of blueprints.**

03.02 TASK: EXPLAIN AND INTERPRET MACHINE PARTS FROM MACHINE DRAWINGS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, assorted machine parts and machine drawings, explain and interpret machine parts from machine drawings.

ENABLING OBJECTIVES:

1. **Identify machine parts.**
2. **Identify machine drawings.**
3. **Explain and interpret machine parts from machine drawings.**

03.03 TASK: READ MACHINE ASSEMBLY DRAWINGS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and a machine assembly drawing, read the drawing.

ENABLING OBJECTIVES:

1. **Interpret assembly machine drawing symbols.**
2. **Differentiate a machine assembly drawing from a schematic.**
3. **Read a machine assembly drawing.**

03.04 TASK: DEVELOP SKETCHES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, necessary materials and guidelines, develop sketches.

ENABLING OBJECTIVES:

1. **Identify a sketch.**
2. **Identify tools and materials for sketching.**
3. **Identify components of a sketch.**
4. **Develop a sketch.**

03.05 TASK: COMPUTE MATERIALS FROM BLUEPRINT DRAWINGS

LEVEL R **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint for a given project, and references, compute materials from blueprint drawings.

ENABLING OBJECTIVES:

1. Explain basic math skills required to compute materials.
2. Identify requirements from a given blueprint.
3. Compute materials from a given blueprint.

03.06 TASK: INTERPRET BUILDING DRAWINGS

LEVEL R **PERFORMANCE OBJECTIVE:** Given instruction, necessary references and building drawings, interpret building drawings.

ENABLING OBJECTIVES:

1. Discuss the use of building drawings.
2. Interpret building plans, including site plans, floor plans, elevation plans, sections, mechanical and electrical plans.

03.07 TASK: READ AND INTERPRET SCHEMATICS AND SYMBOLS

LEVEL **PERFORMANCE OBJECTIVE:** Given instruction, references, and schematic drawings, read and interpret schematics and symbols.

ENABLING OBJECTIVES:

1. Explain the use of schematic drawings.
2. Identify schematic drawing symbols.
3. Read and interpret schematic drawings and symbols.

03.08 TASK: IDENTIFY COMMON FEATURES AND DIFFERENCES OF SCHEMATICS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and schematic drawings, identify common features and differences of schematics.

ENABLING OBJECTIVES:

1. Identify three systems often outlined in schematics.
2. Discuss common features of a variety of schematic prints.
3. Identify common features and differences of schematics.

03.09 TASK: IDENTIFY ELECTRICAL WIRES AND CONNECTIONS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, references, and an assortment of electric wires and connections, identify electric wires and connections.

ENABLING OBJECTIVES:

1. Discuss the purpose(s) of electric wires and connectors.
2. Identify different types of wire and connections.
3. Identify different types of wire and connections in a schematic.

03.10 TASK: READ ELECTRICAL DIAGRAMS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, electrical diagrams, and references, read an electrical diagram.

ENABLING OBJECTIVES:

1. Discuss electrical diagrams.
2. Identify electrical symbols.
3. Identify kinds of electrical circuits.
4. Read electrical diagrams.

03.11 TASK: IDENTIFY PIPING SYSTEMS, PROJECTIONS, JOINTS, VALVES AND SYMBOLS

LEVEL E PERFORMANCE OBJECTIVE: Given instructions, piping prints, and references, identify piping systems, projections, joints, valves, and symbols.

ENABLING OBJECTIVE:

1. Discuss standard symbols for plumbing.
2. Interpret standard plumbing symbols on a print.
3. Discuss the components of piping systems.
4. Identify piping systems including projections, joints, valves, and symbols.

03.12 TASK: READ A PIPING SCHEMATIC

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, piping schematics, and references, read a piping schematic.

ENABLING OBJECTIVES:

1. Discuss piping schematics as compared to drawings.
2. Discuss piping schematics as compared to other related schematics.
3. Read a basic piping schematic.

03.13 TASK: IDENTIFY FLUID POWER SYSTEM COMPONENT SYMBOLS AND INTERPRET DIAGRAMS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and fluid power diagrams, identify fluid power systems component symbols and interpret diagrams.

ENABLING OBJECTIVES:

1. Discuss fluid power systems.
2. Discuss fluid power component symbols.
3. Identify fluid power system component symbols.
4. Interpret fluid power system diagrams.

03.14 TASK: INTERPRET AIR CONDITIONING AND REFRIGERATION SYSTEM AND SUBSYSTEM SCHEMATICS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and appropriate schematics, interpret air conditioning and refrigeration system and subsystem schematics.

ENABLING OBJECTIVES:

1. Discuss air conditioning and refrigeration systems and subsystems.
2. Identify air conditioning and refrigeration symbols.
3. Interpret air conditioning and refrigeration subsystem schematics.

03.15 TASK: IDENTIFY SYMBOLS FOR WELDS

LEVEL PERFORMANCE OBJECTIVE: Given instruction, references, and appropriate blueprints, identify symbols for welds.

ENABLING OBJECTIVES:

1. Discuss weld symbols.
2. Identify weld symbols.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 4

DEMONSTRATE SHOP SKILLS

MODULE 4 - DEMONSTRATE SHOP SKILLS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 4 - DEMONSTRATE SHOP SKILLS

The student will be able to:

LEVEL

- E 04.01 Add, subtract, multiply, and divide positive and negative numbers.**
- E 04.02 Add, subtract, multiply, and divide fractions.**
- E 04.03 Change mixed numbers to decimals.**
- E 04.04 Compare numbers and calculate ratios.**
- E 04.05 Demonstrate understanding of geometric functions.**
- E 04.06 Solve algebraic equations.**
- E 04.07 Explain the properties of triangles.**
- E 04.08 Apply trigonometric functions to layout and installation situations.**
- E 04.09 Demonstrate an understanding of metric and linear measurement.**
- E 04.10 Measure bulk materials.**
- R 04.11 Use plumbing codes to determine materials.**
- E 04.12 Explain techniques of measuring motion, forces, fluids, electricity, and temperature.**
- E 04.13 Explain the mechanical and chemical properties of ferrous and non-ferrous metals.**
- E 04.14 Explain industrial manufacturing processes.**
- E 04.15 Explain the industrial use of non-metallic solids, liquids, and gases.**
- E 04.16 Explain the precautions required when using toxic or flammable materials.**
- E 04.17 Demonstrate the use and maintenance of personal protective equipment.**

DEMONSTRATE SHOP SKILLS

04.01 TASK: ADD, SUBTRACT, MULTIPLY, AND DIVIDE POSITIVE AND NEGATIVE NUMBERS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and materials, add, subtract, multiply, and divide positive and negative numbers, manually and with a calculator with 100% accuracy.

ENABLING OBJECTIVES:

1. Add four multi-digit positive numbers, negative numbers and mixed numbers.
2. Subtract four multi-digit positive numbers, negative numbers, and mixed numbers.
3. Multiply two four digit whole numbers, decimal numbers, negative numbers, and mixed numbers.
4. Divide two multi-digit whole numbers, decimal numbers, negative numbers, and mixed numbers.
5. Divide a larger number into a smaller number,

04.02 TASK: ADD, SUBTRACT, MULTIPLY, AND DIVIDE FRACTIONS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and materials, manually compute fractions with values greater and smaller than one, with 100% accuracy.

ENABLING OBJECTIVES:

1. Add three fractions with like and unlike denominators.
2. Subtract three fractions with like and unlike denominators.
3. Multiply fractions with like and unlike denominators.
4. Divide fractions with like and unlike denominators.

04.03 TASK: CHANGE MIXED NUMBERS TO DECIMALS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and materials, change mixed numbers to decimals.

ENABLING OBJECTIVES:

1. Explain procedure for changing mixed numbers to decimals.
2. Demonstrate changing mixed numbers to decimals.

04.04 TASK: COMPARE NUMBERS AND CALCULATE RATIOS.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and materials, compare two numbers and calculate their ratios.

ENABLING OBJECTIVES:

1. Discuss ratios.
2. Explain procedure for computation of ratios.
3. Calculate ratios.

04.05 TASK: DEMONSTRATE UNDERSTANDING OF GEOMETRIC FUNCTIONS.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and materials, demonstrate understanding of geometric functions.

ENABLING OBJECTIVES:

1. Discuss uses of geometric functions.
2. Define geometric terms.
3. Demonstrate use of geometric functions.

04.06 TASK: SOLVE ALGEBRAIC EQUATIONS.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and materials, solve simple algebraic equations.

ENABLING OBJECTIVES:

1. Explain procedures for solving equations.
2. Solve simple algebraic equations.
3. Prove calculations.

04.07 TASK: EXPLAIN THE PROPERTIES OF TRIANGLES.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and materials, explain the properties of triangles.

ENABLING OBJECTIVES:

1. Discuss structural characteristics and terms.
2. Discuss sum of angles in triangles and Pythagorean Method $A^2 + B^2 = C^2$

04.08 TASK: APPLY TRIGONOMETRIC FUNCTIONS TO LAYOUT AND INSTALLATION SITUATIONS.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and materials, apply trigonometric functions to layout and installation situations.

ENABLING OBJECTIVES:

1. Discuss special triangles: 30 - 60 - 90 degrees; 45 - 45 - 90 degrees: and 3 - 4 - 5 degrees, to layout problems.
2. Discuss sine, cosine, and tangent problem solving methods for layout and installation.

04.09 TASK: DEMONSTRATE AN UNDERSTANDING OF METRIC LINEAR MEASUREMENT.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and materials, measure object of various sizes, measure and record dimensions in linear metric units.

ENABLING OBJECTIVES:

1. Measure objects in millimeters, centimeters, and meters.
2. Convert between linear metric units.
3. Explain the significance of decimal point placement.
4. Compare the numerical value of milli-, centi-, kilo-, and mega-, to a meter unit.

04.10 TASK: MEASURE BULK MATERIALS.

LEVEL E PERFORMANCE OBJECTIVE: Given instructions, reference materials, and necessary equipment, measure and compute bulk materials, manually and with a calculator.

ENABLING OBJECTIVES:

1. Define area; volume; cube; square; pi; radius; and diameter.
2. Compute the area of squares, rectangles, triangles, and circles.
3. Compute the area of irregular objects by breaking them into regular shapes.
4. Compute the volume of cubes, pyramids, and cylinders.
5. Compute the volume of irregular shaped containers.
6. Convert two dimensions into one squared dimension.
7. Convert three dimensions into one cubed dimension.
8. Demonstrate ability to use correct formulas while measuring bulk materials in a shop.

04.11 TASK: USE PLUMBING CODES TO DETERMINE MATERIALS.

LEVEL R **PERFORMANCE OBJECTIVE:** Given instruction and reference guides, use plumbing codes to determine materials.

ENABLING OBJECTIVES:

1. Identify a plumbing code.
2. Discuss the purpose of plumbing codes.
3. Describe common symbols for plumbing materials.
4. Use a plumbing code to determine materials on a blueprint.

04.12 TASK: EXPLAIN TECHNIQUES OF MEASURING MOTION, FORCES, FLUIDS, ELECTRICITY, AND TEMPERATURE.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and reference materials, explain techniques of measuring motion, forces, fluids, electricity, and temperature.

ENABLING OBJECTIVES:

1. Define motion; force; fluid; electricity; and temperature.
2. Discuss motion and measures of velocity.
3. Discuss force and measures of torque.
4. Discuss fluids and measures of flow (GPM & CFM).
5. Discuss electricity and measures of amps, volts and watts.
6. Discuss temperature and measures in Fahrenheit, Celsius, and Absolute scales.

04.13 TASK: EXPLAIN THE MECHANICAL AND CHEMICAL PROPERTIES OF FERROUS AND NON-FERROUS METALS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and reference materials, explain the mechanical and chemical properties of ferrous and non-ferrous metals.

ENABLING OBJECTIVES:

1. Define ferrous metal, and non-ferrous metal.
2. Discuss the mechanical properties of metals.
3. Discuss the chemical properties of metals.
4. Discuss the uses of ferrous metals in industrial maintenance.
5. Discuss the uses of non-ferrous metals in industrial maintenance.

04.14 TASK: EXPLAIN INDUSTRIAL MANUFACTURING PROCESSES.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and reference materials, both historic and current, explain industrial manufacturing processes.

ENABLING OBJECTIVES:

1. Define industrial manufacturing.
2. Discuss the history of industrial manufacturing.
3. Discuss the purpose(s) of industrial manufacturing processes.
4. Describe various types of processes.
5. Explain an industrial manufacturing process.

04.15 TASK: EXPLAIN THE INDUSTRIAL USE OF NON-METALLIC SOLIDS, LIQUIDS, AND GASES.

LEVEL E PERFORMANCE OBJECTIVE: Given instructions and reference materials, explain the industrial use(s) of non-metallic solids, liquids, and gases.

ENABLING OBJECTIVES:

1. Define non-metallic: a. solid, b. liquid, c. gas.
2. Identify various non-metallic solids.
3. Identify various non-metallic liquids.
4. Identify various non-metallic gases.
5. Discuss common uses of non-metallic solids, liquids, and gases.

04.16 TASK: EXPLAIN THE PRECAUTIONS REQUIRED WHEN USING TOXIC OR FLAMMABLE MATERIALS.

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and reference materials, explain the precautions required when using toxic or flammable materials.

ENABLING OBJECTIVES:

1. Discuss the safety precautions necessary when using toxic materials.
2. Discuss the safety precautions necessary when using flammable materials.
3. Discuss the use of MSDS information sheets.
4. Describe handling methods when using toxic or flammable materials.

04.17 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF PERSONAL PROTECTIVE EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, reference materials, and appropriate equipment, demonstrate the use and maintenance of personal protective equipment.

ENABLING OBJECTIVES:

- 1. Discuss the need for personal protective equipment.**
- 2. Identify various kinds of personal protective equipment.**
- 3. Demonstrate use and care of sight protective equipment.**
- 4. Demonstrate use and care of hearing protective equipment.**
- 5. Demonstrate use and care of hand protective equipment.**
- 6. Demonstrate use and care of other personal protective equipment.**

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 5

USE AND MAINTAIN HAND TOOLS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 5 - USE AND MAINTAIN HAND TOOLS

The student will be able to:

LEVEL

- E 05.01 Demonstrate the use of rules, tapes, calipers, and micrometers.**
- E 05.02 Demonstrate the use of wrenches and screwdrivers.**
- E 05.03 Demonstrate the use and care of pipefitting tools.**
- E 05.04 Demonstrate the use of line clearing equipment.**
- E 05.05 Demonstrate the use of equipment used to bend and assemble electrical conduit.**
- E 05.06 Demonstrate the use and care of woodworking tools, including saws, planes, drills, hammers, nail sets, and marking gauges.**
- E 05.07 Demonstrate the use and care of sheet metal tools, including sheet metal gauges, layout tools, dividers, punches, nibblers, riveting tools, metal cutting chisels, metal cutting snips, forming tools, hand seamers, and soldering irons.**
- E 05.08 Demonstrate proper metalworking bench skills, including the use of vices, hacksaws, files, tapes, dies, and reamers.**
- E 05.09 Demonstrate the use and care of ropes, slings, pulleys, and block and tackle.**
- E 05.10 Demonstrate the use and care of test and safety equipment.**

USE AND MAINTAIN HAND TOOLS

05.01 TASK: DEMONSTRATE THE USE OF RULES, TAPES, CALIPERS & MICROMETERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and equipment, demonstrate a complete understanding of the following measuring devices: rules, tapes, calipers, and micrometers.

ENABLING OBJECTIVES:

1. **Demonstrate the understanding of fractions.**
2. **Demonstrate the understanding of decimals.**
3. **Explain the use of micrometers.**
4. **Demonstrate the proper use of:**
 - A. Rules
 - B. Tapes
 - C. Calipers
 - D. Micrometers

05.02 TASK: DEMONSTRATE THE USE OF WRENCHES AND SCREWDRIVERS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction and the various types of screwdrivers and wrenches, demonstrate the use of wrenches and screwdrivers.

ENABLING OBJECTIVES:

1. **Explain safety rules for using screwdrivers and wrenches.**
2. **Explain the different types of screwdrivers and wrenches and their uses.**
3. **Demonstrate how to maintain and use screwdrivers and wrenches.**

05.03 TASK: DEMONSTRATE THE USE AND CARE OF PIPEFITTING TOOLS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, pipefitting tools and necessary equipment, demonstrate the use and care of pipefitting tools.

ENABLING OBJECTIVES:

1. **Explain safety procedures for using pipefitting tools.**
2. **List the different pipefitting tools.**
3. **List the different types of pipe joints.**
4. **Demonstrate the different types of pipefitting tools and their uses.**
5. **Demonstrate how to maintain different pipefitting tools.**

05.04 TASK: DEMONSTRATE THE USE OF LINE CLEARING EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, line clearing equipment, and necessary materials, demonstrate the use of line clearing equipment.

ENABLING OBJECTIVES:

1. **Explain safety procedures for using line clearing equipment.**
2. **Discuss common line problems requiring clearing.**
3. **Identify several types of line clearing equipment.**
4. **Demonstrate a line clearing procedure.**

05.05 TASK: **DEMONSTRATE THE USE OF EQUIPMENT USED TO BEND AND ASSEMBLE ELECTRICAL CONDUIT**

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and the proper equipment, demonstrate the use of equipment used to bend and assemble rigid electrical conduit.

ENABLING OBJECTIVES:

1. **Discuss safety precautions for conduit bending and assembly.**
2. **Identify various types of electrical conduit.**
3. **Identify the different conduit tools and joints.**
4. **Demonstrate proper conduit bending and assembly.**

05.06 TASK: **DEMONSTRATE THE USE AND CARE OF WOODWORKING TOOLS, INCLUDING SAWS, PLANES, DRILLS, HAMMERS, NAIL SETS AND MARKING GAUGES.**

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, woodworking tools, and necessary materials, demonstrate the use and care of these tools.

ENABLING OBJECTIVES:

1. **Explain the safety rules for each woodworking tool.**
2. **List the different uses of each woodworking tool.**
3. **Demonstrate the different woodworking tools and their uses.**
4. **Explain the relevant safety procedures for each woodworking tool.**

05.07 TASK: DEMONSTRATE THE USE AND CARE OF SHEET METAL TOOLS INCLUDING SHEET METAL GAUGES, LAYOUT TOOLS, DIVIDERS, PUNCHES, NIBBLERS, RIVETING TOOLS, METAL CUTTING CHISELS, METAL CUTTING SNIPS, FORMING TOOLS, HAND SEAMERS, AND SOLDERING IRONS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, sheet metal tools and necessary materials, demonstrates use and care of these tools.

ENABLING OBJECTIVES:

1. Explain the safety rules for each sheet metal tool.
2. Identify the different types of sheet metal tools.
3. Explain the uses of each sheet metal tool.
4. Demonstrate the use of each sheet metal tool.
5. Demonstrate how to maintain different sheet metal tools.

05.08 TASK: DEMONSTRATE PROPER METALWORKING BENCH SKILLS INCLUDING THE USE OF VICES, HACKSAWS, FILES, TAPS, DIES, AND REAMERS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, bench metalworking tools, and necessary materials, demonstrate proper metalworking bench skills using these tools.

ENABLING OBJECTIVES:

1. Explain the safety rules for each metalworking tool.
2. Identify the different types of metal working tools.
3. Demonstrate proper metalworking bench skills.
4. Demonstrate how to maintain different metalworking tools.

05.09 TASK: DEMONSTRATE THE USE AND CARE OF ROPES, SLINGS, PULLEYS, AND BLOCK AND TACKLE

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, appropriate equipment, and necessary materials, demonstrate the use and care of ropes, slings, pulleys, and block and tackle.

ENABLING OBJECTIVES:

1. Explain safety procedures when using ropes and block and tackle.
2. Explain the theory of the block and tackle.
3. Identify the different types of rope equipment.
4. Demonstrate use of ropes with slings, pulleys and block and tackle.

05.10 TASK: DEMONSTRATE THE USE AND CARE OF TEST AND SAFETY EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, test and safety equipment, and necessary materials, demonstrate the use and care of the equipment in accordance with manufacturers specifications.

ENABLING OBJECTIVES:

- 1. Explain the uses of test and safety equipment.**
- 2. Identify the different types of test and safety equipment.**
- 3. Demonstrate proper use of test equipment.**
- 4. Demonstrate proper use of safety equipment.**
- 5. Demonstrate how to maintain test and safety equipment.**

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 6

USE AND MAINTAIN PORTABLE POWER TOOLS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 6 - USE AND MAINTAIN PORTABLE POWER TOOLS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 06.01 | Demonstrate the use and maintenance of light-duty and heavy-duty drills. |
| E | 06.02 | Demonstrate the use and maintenance of electric hammers. |
| E | 06.03 | Demonstrate the use and maintenance of pneumatic drills and hammers. |
| E | 06.04 | Demonstrate the use and maintenance of power screwdrivers and impact wrenches. |
| E | 06.05 | Demonstrate the use and maintenance of linear motion saws. |
| E | 06.06 | Demonstrate the use and maintenance of circular saws. |
| E | 06.07 | Demonstrate the use and maintenance of routers and planes. |
| E | 06.08 | Demonstrate the use and maintenance of belt, pad and disc sanders. |
| E | 06.09 | Demonstrate the use and maintenance of grinders and shears. |
| A | 06.10 | Demonstrate the use and maintenance of explosive actuated tools. |
| E | 06.11 | Sharpen tools using a bench grinder. |

USE AND MAINTAIN PORTABLE POWER TOOLS

06.01 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF LIGHT-DUTY AND HEAVY-DUTY DRILLS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, drills, and necessary materials, demonstrate the use and maintenance of light-duty and heavy duty drills.

ENABLING OBJECTIVES:

1. Explain the safety precaution when using power drills.
2. Explain the uses of different types of drills.
3. Demonstrate drill applications.
4. Demonstrate light-duty and heavy-duty drill maintenance.

06.02 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF ELECTRIC HAMMERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, electric hammers, and necessary materials, demonstrate the use and maintenance of electric hammers.

ENABLING OBJECTIVES:

1. Explain the safety precautions when using electric hammers.
2. Demonstrate the use of electric hammers.
3. Demonstrate electric hammer maintenance.

06.03 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF PNEUMATIC DRILLS AND HAMMERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, pneumatic drills and hammers, and necessary materials, demonstrate the use and maintenance of pneumatic drills and hammers.

ENABLING OBJECTIVES:

1. Explain safety precautions when using pneumatic drills and hammers.
2. Demonstrate the use of pneumatic drills and hammers.
3. Demonstrate pneumatic drill and hammer maintenance.

06.04 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF POWER SCREWDRIVERS AND IMPACT WRENCHES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, power screwdrivers and impact wrenches, and necessary materials, demonstrate the use and maintenance of power screwdrivers and impact wrenches.

ENABLING OBJECTIVES:

1. Explain safety precautions when using power screwdrivers and impact wrenches.
2. Demonstrate the use of power screwdrivers and impact wrenches.
3. Demonstrate power screwdriver and impact wrench maintenance.

06.05 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF LINEAR MOTION SAWS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a linear motion saw, and necessary materials, demonstrate the use and maintenance of a linear motion saw.

ENABLING OBJECTIVES:

1. Explain safety precautions when using linear motion saws.
2. Demonstrate the use of linear motion saws.
3. Demonstrate linear motion saw maintenance.
4. Explain the application of different linear saw blades.

06.06 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF CIRCULAR SAWS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a circular saw, and necessary materials, demonstrate the use and maintenance of a circular saw.

ENABLING OBJECTIVES:

1. Explain safety precautions when using circular saws.
2. Demonstrate the use of circular saws.
3. Explain the different saw blades and their uses.
4. Demonstrate circular saw maintenance.

06.07 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF ROUTERS AND PLANES

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, routers and planes, and necessary materials, demonstrate use and maintenance of a router and a plane.

ENABLING OBJECTIVES:

1. Explain safety precautions when using routers and planes.
2. Demonstrate the use of routers, and planes.
3. Explain the types and uses of router bits.
4. Demonstrate router and plane maintenance.

06.08 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF BELT, PAD, AND DISC SANDERS

LEVEL E PERFORMANCE OBJECTIVE: Given instructions, belt sander, pad sander and disc sander, and necessary materials, demonstrate use and maintenance of belt, pad, and disc sanders.

ENABLING OBJECTIVES:

1. Explain safety precautions when using power sanders.
2. Demonstrate the use of belt, pad, and disc sanders.
3. Explain the grit types and uses of sandpaper.
4. Demonstrate sander maintenance.

06.09 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF GRINDERS AND SHEARS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, grinders and shears, and necessary materials, demonstrate use and maintenance of grinders and shears.

ENABLING OBJECTIVES:

1. Explain safety precautions when using grinders and shears.
2. Demonstrate the use of grinders and shears.
3. Explain the types and uses of grinding discs.
4. Demonstrate grinder and shear maintenance.

06.10 TASK: DEMONSTRATE THE USE AND MAINTENANCE OF EXPLOSIVE ACTUATED TOOLS

LEVEL A **PERFORMANCE OBJECTIVE:** Given instruction, explosive actuated tools, and necessary materials, demonstrate the use and maintenance of explosive activated tools.

ENABLING OBJECTIVES:

1. Explain safety precautions when using explosive actuated tools.
2. Discuss the types and use of shells for explosive tools.
3. Demonstrate the use of explosive actuated tools.
4. Demonstrate explosive actuated tool maintenance.

06.11 TASK: SHARPEN TOOLS USING A BENCH GRINDER

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, hand tools and bits, and necessary materials, sharpen tools using a bench grinder.

ENABLING OBJECTIVES:

1. Explain safety precautions when using a bench grinder.
2. Demonstrate the correct way to sharpen a chisel.
3. Demonstrate the correct way to sharpen drill bits.
4. Demonstrate the correct way to sharpen saw blades.

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

**MODULE 7
USE STATIONARY SHOP EQUIPMENT**

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 7 - USE STATIONARY SHOP EQUIPMENT

The student will be able to:

LEVEL

- E 07.01 Demonstrate the use of mechanical presses.**
- E 07.02 Demonstrate the use of hydraulic presses.**
- E 07.03 Demonstrate the use of drill presses.**
- E 07.04 Demonstrate the use of bench grinders.**
- E 07.05 Demonstrate the use of power hack saws, cut-off saws or chop saws.**
- E 07.06 Demonstrate the use of band saws.**
- E 07.07 Demonstrate the use of pipe threaders.**
- E 07.08 Demonstrate the use of power metal brakes.**
- E 07.09 Demonstrate the use of power shears.**

USE STATIONARY SHOP EQUIPMENT

07.01 TASK: DEMONSTRATE THE USE OF AN ARBOR PRESS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a mechanical press, and necessary accessories, demonstrate the use of an arbor press.

ENABLING OBJECTIVES:

1. **Explain the safety precautions when using an arbor press.**
2. **Discuss the uses of an arbor press.**
3. **Identify the parts of an arbor press.**
4. **Explain the importance of using manuals when performing operations.**
5. **Demonstrate the use of an arbor press.**

07.02 TASK: DEMONSTRATE THE USE OF HYDRAULIC PRESSES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a hydraulic press, and necessary accessories, demonstrate the use of a hydraulic press.

ENABLING OBJECTIVES:

1. **Explain the safety precautions when using an hydraulic press.**
2. **Discuss the uses of a hydraulic press.**
3. **Identify the parts of a hydraulic press.**
4. **Discuss types of oil used in hydraulic presses.**
5. **Explain the importance of using manuals when performing operations.**
6. **Demonstrate the use of a hydraulic press.**

07.03 TASK: DEMONSTRATE THE USE OF DRILL PRESSES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a drill press, drill bits, clamps, and necessary accessories, demonstrate the use of a drill press.

ENABLING OBJECTIVES:

1. **Explain the safety precautions when using drill presses.**
2. **Discuss the uses of a drill press.**
3. **Identify the types of drill presses.**
4. **Identify parts of drill presses.**
5. **Identify types of cutters.**
6. **Discuss cooling solutions.**
7. **Demonstrate use of a drill press.**

07.04 TASK: DEMONSTRATE THE USE OF BENCH GRINDERS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a bench grinder, grinding wheels, and necessary accessories, demonstrate the use of bench grinders.

ENABLING OBJECTIVES:

1. Explain the safety precautions when using bench grinders.
2. Discuss the uses of a bench grinder.
3. Explain the importance of using manuals when performing operations.
4. Demonstrate the use of a bench grinder.

07.05 TASK: DEMONSTRATE THE USE OF POWER HACK SAWS, CUT-OFF SAWS OR CHOP SAWS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a power hack saw, cut-off saw, chop saw, and necessary accessories, demonstrate the use of these saws.

ENABLING OBJECTIVES:

1. Explain the safety precautions when using power saws.
2. Identify power hack saws, cut-off saws, and chop saws.
3. Discuss uses of each type of saws.
4. Explain the different saw blades.
5. Demonstrate use of a power hack saw, cut-off saw and a chop saw.

07.06 TASK: DEMONSTRATE THE USE OF BAND SAWS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a band saw, and necessary accessories, demonstrate the use of a band saw.

ENABLING OBJECTIVES:

1. Explain the safety precautions when using band saws.
2. Identify different blades.
3. Demonstrate use of band saw.

07.07 TASK: DEMONSTRATE THE USE OF PIPE THREADERS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction a pipe threader, tools, and necessary accessories, demonstrate use of a pipe threader.

ENABLING OBJECTIVES:

1. Explain safety precautions when using a pipe threader.
2. Identify the parts of a pipe threader.
3. Demonstrate the use of a pipe threader.

07.08 TASK: DEMONSTRATE THE USE OF POWER METAL BRAKES

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a power metal brake, tools, and necessary accessories, demonstrate the use of a power metal brake.

ENABLING OBJECTIVES:

1. Explain the safety precautions when using a power metal brake.
2. Identify the parts of a power metal brake.
3. Describe the function of each part.
4. Demonstrate the use of a power metal brake.

07.09 TASK: DEMONSTRATE THE USE OF POWER SHEARS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a power shears, and necessary accessories, demonstrate the use of power shears.

ENABLING OBJECTIVES:

1. Explain the safety precautions when using power shears.
2. Describe the uses of power shears.
3. Identify the parts of power shears.
4. Demonstrate the use of power shears.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 8

DEMONSTRATE TROUBLESHOOTING SKILLS

MODULE 8 - DEMONSTRATE TROUBLESHOOTING SKILLS

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Although some provision is made for basic mathematics and communication skills within this guide, they may not be adequate to meet the needs of individual students. Counseling, guidance, and diagnostic test results may indicate a need for further preparation in these areas. In such cases, instructors are encouraged to utilize the resources and personnel within the institution to improve or complement the instructional process.

The benefits to students and institutions derived from this curriculum guide should be considerable. Articulation of students from secondary to post-secondary programs will be aided through the use of a single curriculum guide. The guide provides a tool for evaluation of local curriculum and programs. The guide may be used in a flexible manner to assure that industrial mechanics programs meet the needs of local business and industry.

It is the goal of this program guide to provide a level of instruction which will impart entry level employment skills. Students should be carefully counseled on the importance of attaining competency in the tasks assigned. As in virtually all occupations today industrial mechanics will require periodic up-dating and review in the future. It is important that each student understand that meeting the program standards is essential not only to obtain employment today but also to have a base upon which to retain employment in the future.

IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 8 - DEMONSTRATE TROUBLESHOOTING SKILLS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 08.01 | Explain the importance of maintenance. |
| E | 08.02 | Explain troubleshooting procedures. |
| E | 08.03 | Identify aids to troubleshooting. |
| E | 08.04 | Demonstrate safe troubleshooting and repair procedures. |
| R | 08.05 | Maintain troubleshooting and repair records. |
| E | 08.06 | Demonstrate use of manufacturer's manuals, schematics, and troubleshooting charts, as well as general machinery manuals and references. |

DEMONSTRATE TROUBLESHOOTING SKILLS

08.01 TASK: EXPLAIN THE IMPORTANCE OF MAINTENANCE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and necessary manuals, explain the importance of maintenance.

ENABLING OBJECTIVES:

1. **Discuss importance of reducing down time.**
2. **Discuss maintenance procedures.**

08.02 TASK: EXPLAIN TROUBLESHOOTING PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a machine, and appropriate manuals, explain troubleshooting procedures.

ENABLING OBJECTIVES:

1. **Explain the safety precautions when doing troubleshooting.**
2. **Discuss the use of manuals in troubleshooting.**
3. **Explain troubleshooting procedures.**

08.03 TASK: IDENTIFY AIDS TO TROUBLESHOOTING PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, and other reference materials, identify aids to troubleshooting procedures.

ENABLING OBJECTIVES:

1. **Discuss troubleshooting aids.**
2. **List the troubleshooting aids available in your shop.**

08.04 TASK: DEMONSTRATE SAFE TROUBLESHOOTING AND REPAIR PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, tools, safety lists, and machinery, demonstrate safe troubleshooting and repair procedures.

ENABLING OBJECTIVES:

1. **Explain the safety precautions that must be taken when examining or repairing machinery.**
2. **Demonstrate safe troubleshooting and repair procedures.**

08.05 TASK: MAINTAIN TROUBLESHOOTING AND REPAIR RECORDS

LEVEL R **PERFORMANCE OBJECTIVE:** Given instruction, manuals, and sample records, maintain troubleshooting and repair records.

ENABLING OBJECTIVES:

- 1. Discuss need for records.**
- 2. Identify the types of records.**
- 3. Maintain troubleshooting and repair records.**

08.06 TASK: DEMONSTRATE USE OF MANUFACTURER'S MANUALS, SCHEMATICS, AND TROUBLESHOOTING CHARTS, AS WELL AS GENERAL MACHINERY MANUALS AND REFERENCES, IN TROUBLESHOOTING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, schematics, troubleshooting charts and general machinery references, demonstrate their use in troubleshooting.

ENABLING OBJECTIVES:

- 1. Discuss use of manuals.**
- 2. Discuss use of schematics.**
- 3. Discuss use of charts.**
- 4. Discuss use of general machinery references.**
- 5. Demonstrate use of manufacturer's manuals, schematics, troubleshooting charts, and general machinery references, in troubleshooting.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

MODULE 9

PERFORM GAS WELDING/CUTTING

MODULE 9- PERFORM GAS WELDING/CUTTING

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It is the goal of this program guide to provide a level of instruction which will impart entry level employment skills. Students should be carefully counseled on the importance of attaining competency in the tasks assigned. As in virtually all occupations today industrial mechanics will require periodic up-dating and review in the future. It is important that each student understand that meeting the program standards is essential not only to obtain employment today but also to have a base upon which to retain employment in the future.

IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 9 - PERFORM GAS WELDING/CUTTING

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 09.01 | Set up gas welding and cutting equipment and accessories. |
| E | 09.02 | Identify personal protective equipment required for welding and cutting. |
| E | 09.03 | Explain capillary attraction as it applies to metal joining. |
| E | 09.04 | Demonstrate proper lighting, adjusting, and shutting down of a gas torch. |
| E | 09.05 | Layout and cut mild steel. |
| E | 09.06 | Braze mild steel. |
| E | 09.07 | Braze cast iron. |
| E | 09.08 | Solder non-ferrous metals. |

PERFORM GAS WELDING/CUTTING

09.01 TASK: SET UP GAS WELDING, CUTTING EQUIPMENT AND ACCESSORIES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, necessary references, oxyacetylene torch, regulators, hoses, check valves, cylinder wrench, personal safety equipment, oxygen and fuel cylinders; set up an oxyacetylene welding station. The oxyacetylene equipment will not leak and will operate safely according to the manufacturer's specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions for setting up an oxyacetylene welding station.
2. Identify oxygen and acetylene cylinders.
3. List the safety rules when handling gas cylinders.
4. List the safety rules when setting up oxyacetylene equipment.
5. Identify oxygen and acetylene regulators.
6. List the purpose and types of oxyacetylene regulators.
7. Identify oxygen and acetylene hose.
8. Describe the purpose of the torch and needle valve.
9. Discuss the two general classes of torches.
10. Demonstrate the correct sequence for the set up.
11. Describe leak detection and repair methods.
12. Demonstrate hose cleaning methods.
13. Demonstrate cylinder valve cleaning methods.

09.02 TASK: IDENTIFY PERSONAL PROTECTIVE SAFETY EQUIPMENT REQUIRED FOR WELDING AND CUTTING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, personal safety equipment, and information on a specific gas welding/cutting procedure, identify the personal protective equipment required.

ENABLING OBJECTIVES:

1. Explain the safety precautions when operating gas welding equipment.
2. Explain the use of personal safety equipment.
3. Identify common welding hazards.

09.03 TASK: EXPLAIN CAPILLARY ATTRACTION AS IT APPLIES TO METAL JOINING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shop demonstrations of metal joining procedures, and necessary references, explain capillary attraction as it applies to metal joining.

ENABLING OBJECTIVES:

1. Define capillary attraction.
2. Explain capillary attraction as it applies to metal joining.

09.04 TASK: DEMONSTRATE PROPER LIGHTING, ADJUSTING, AND SHUTTING DOWN OF A GAS

TORCH

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, an oxyacetylene welding station, a selection of tips, personal safety equipment and access to the necessary tools and equipment, properly light, adjust and shut down a gas torch. Produce a neutral, and oxidizing, and a carburizing flame. Each flame will be the correct size and color, and have a distinct appearance.

ENABLING OBJECTIVES:

1. Explain safety precautions when lighting, adjusting and shutting down a gas torch.
2. Explain the purpose of the tip.
3. Specify pressures for each size.
4. Describe the proper procedure for cleaning a tip.
5. Describe the spark lighter.
6. Identify the three parts of the flame.
7. Distinguish the three flames by size.
8. Discuss the purpose for adjusting each flame.
9. Distinguish types of flame by color.
10. Demonstrate the manufacturer's approved procedure for lighting the model torch being used.
11. Demonstrate the sequence for closing down the welding station.

09.05 TASK: LAY OUT AND CUT MILD STEEL

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, cutting specifications, 1/8" to 1" thick mild steel, layout instruments, oxy-fuel cutting station, and personal safety equipment; lay out and cut straight lines in mild steel plates. Cut will be within 1/16" of specifications and plates will maintain conformity throughout the length of the cuts without any underside slag.

ENABLING OBJECTIVES:

1. Explain safety procedures when cutting mild steel.
2. Identify, select, and demonstrate the use of lay out instruments.
3. Describe the procedures for laying out and cutting lines on mild steel.
4. Select cutting tip for mild steel plates.
5. Demonstrate procedures for lighting torch and adjusting flame.
6. Demonstrate procedures for cutting straight lines in mild steel.

09.06 TASK: BRAZE MILD STEEL

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, an oxyacetylene welding station, mild steel coupon, brazing rod, flux, personal safety equipment and the necessary tools and materials, braze mild steel. Bead must be straight and uniform in height and width; have a uniform ripple formation; and have no undercut, porosity, craters or oxidation.

ENABLING OBJECTIVES:

1. Explain safety procedures when brazing mild steel..
2. Define brazing.
3. Explain the difference between brazing and welding.
4. Identify applications for brazing.
5. Identify types of mild steel which require brazing.
6. Determine temperatures required for brazing.
7. Explain function of flux in brazing.
8. Identify brazing rods by size and type for brazing mild steel.
9. Explain how puddle buildup can be accomplished.
10. Explain angle and position of the rod.
11. Describe ripple spacing techniques.
12. Describe how width and height of bead can be controlled.
13. Demonstrate rod and torch movement for brazing.
14. Demonstrate procedures for brazing mild steel.

09.07 TASK: BRAZE CAST IRON

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, an oxyacetylene welding station, cast iron coupon, brazing rod, flux, personal safety equipment and the necessary tools and materials; braze cast iron. Bead must be straight and uniform in height and width; have a uniform ripple formation; and have no undercut, porosity, craters or oxidation.

ENABLING OBJECTIVES:

1. Explain safety procedures when brazing cast iron.
2. Explain the difference between brazing and welding.
3. Identify applications for brazing.
4. Determine temperatures required for brazing.
5. Explain function of flux in brazing.
6. Identify brazing rods by size and type for brazing cast iron.
7. Explain the angle and position of the rod.
8. Demonstrate rod and torch movement for brazing.
9. Demonstrate procedures for brazing cast iron.

09.08 TASK: SOLDER NON-FERROUS METALS

LEVEL E

PERFORMANCE OBJECTIVE: Given instruction, references, an oxyacetylene welding station, copper plate or pipe, soft solder, flux, personal safety equipment and the necessary tools, materials; soft solder copper joints in plate or pipe. Bond must have uniform coverage over the joint area and have no porosity or oxidation.

ENABLING OBJECTIVES:

1. Explain safety procedures when soldering non-ferrous metals.
2. Define soft soldering.
3. Explain the difference between soldering, brazing, and welding.
4. Identify proper solder grade, size and flux for copper joints.
5. Describe surface preparation procedures.
6. Explain procedures for lighting torch and adjusting flame.
7. Describe rod and torch movement for soft soldering on copper joints.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 10

PERFORM ARC WELDING/CUTTING

MODULE 10 - PERFORM ARC WELDING/CUTTING

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 10 - PERFORM ARC WELDING/CUTTING

The student will be able to:

LEVEL

- E 10.01 Set up and adjust a shielded metal arc welder.**
- E 10.02 Identify and select electrodes.**
- E 10.03 Strike, maintain and restart an S.M.A.W. arc.**
- E 10.04 Weld straight bead in flat position.**
- E 10.05 Weld weave bead patterns.**
- E 10.06 Weld build-up pads.**
- E 10.07 Weld basic joints in flat position (1G and 1F).**
- E 10.08 Weld basic joints in horizontal position (2G and 2F).**
- E 10.09 Weld basic joints in vertical position (3G and 3F).**
- E 10.10 Weld basic joints in overhead position (4G and 4F).**
- E 10.11 Weld cast iron.**
- E 10.12 Weld alloy steels.**
- E 10.13 Build up shaft or round surface.**
- E 10.14 Weld aluminum.**
- E 10.15 Hard surface metals with S.M.A.W.**
- E 10.16 Set up a gas tungsten arc welder.**
- E 10.17 Select and prepare a tungsten electrode.**
- E 10.18 Strike and maintain a G.T.A.W. arc.**
- E 10.19 Weld mild steel in all positions (1F thru 4F).**
- E 10.20 Weld stainless steel in all positions (1G thru 4G).**
- E 10.21 Weld aluminum in all positions (1G thru 4G).**
- E 10.22 Set up and adjust G.M.A.W. and F.C.A.W. equipment.**
- E 10.23 Weld weave bead patterns using G.M.A.W and F.C.A.W.**
- E 10.24 Weld basic joints in flat, horizontal, and vertical positions.**
- E 10.25 Set up air carbon arc cutting equipment.**
- E 10.26 Gouge, cut and pierce metals using air carbon arc.**

PERFORM ARC WELDING AND CUTTING

10.01 TASK: SET UP AND ADJUST A SHIELDED METAL ARC WELDER

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, proper welding equipment including a DC motor generator, an AC transformer, and an AC/DC transformer-rectifier, and demonstrations, set up and adjust a shielded metal arc welder.

ENABLING OBJECTIVES:

1. Explain safety precautions when setting up S.M.A.W. equipment.
2. Explain polarity.
3. Describe process for switching polarity.
4. Explain use of remote and panel control switch.
5. Explain the role of arc adjusting in welding.
6. Set up and adjust a shielded metal arc welder.

10.02 TASK: IDENTIFY AND SELECT ELECTRODES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, welding electrodes, and necessary references, identify and select electrodes.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with electrodes.
2. Explain electrode identification and numbering system (A.W.S.).
3. Describe mild steel electrodes and their application.
4. Describe copper base electrodes and their application.
5. Describe nickel electrodes and their application.
6. Describe stainless steel electrodes and their application.
7. Identify other types of electrodes.

10.03 TASK: STRIKE, MAINTAIN AND RESTART AN S.M.A.W. ARC

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, necessary tools and material, and personal safety equipment, strike, maintain and restart an S.M.A.W. arc to industrial standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Adjust machine current and polarity setting for 1/8 inch electrode.
3. Select 1/8 E6010 or E7018 electrode.
4. Clean the metal to be welded.
5. Strike an arc using the tapping method and the scratching method.
6. Restart an arc.

10.04 TASK: WELD STRAIGHT BEAD IN FLAT POSITION

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, necessary tools and materials, and personal safety equipment, weld straight bead in flat position to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Select the proper electrode.
3. Set the welding machine for current and polarity.
4. Strike an arc with proper length for desired bead contour.
5. Weld straight bead in flat position.

10.05 TASK: WELD WEAWE BEAD PATTERNS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, necessary tools and materials, and personal safety equipment, weld weave bead patterns in the flat position to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Select the proper electrode.
3. Set the welding machine for current and polarity.
4. Explain reason for maximizing the width of beads.
5. Weld weave bead patterns in flat position.

10.06 TASK: WELD BUILD UP PADS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, necessary tools and materials, and personal safety equipment, weld build up pads to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W equipment.
2. Select the proper electrode.
3. Set the welding machine for current and polarity.
4. Clean the metal to be welded.
5. Explain the sequence for 1st, 2nd, and 3rd layers.
6. Weld build up pads.

10.07 TASK: WELD BASIC JOINTS IN FLAT POSITION (1G AND 1F)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, E60xx and E7018 electrodes, necessary tools and materials, and personal safety equipment, weld basic joints in flat position (1G and 1F) to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Layout mild steel coupons to form fillet and groove welds in the flat position.
3. Prepare the surfaces for welding.
4. Describe filler material, amperage setting, rod angles, and speed of travel when welding in the flat position.
5. Describe tacking procedures when welding in the flat position.
6. Weld the five basic joints in the flat position using E60xx and E7018 electrodes.
7. Describe the procedure for testing the basic joint welds.

10.08 TASK: WELD BASIC JOINTS IN HORIZONTAL POSITION (2G AND 2F)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, E60xx and E7018 electrodes, necessary tools and materials, and personal safety equipment, weld basic joints in the horizontal position (2G and 2F) to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Layout mild steel coupons to form fillet and groove welds in the horizontal position.
3. Prepare the surfaces for welding.
4. Describe filler material, amperage setting, rod angles, and speed of travel when welding in the horizontal position.
5. Describe tacking procedures when welding in the horizontal position.
6. Weld the five basic joints in the horizontal position using E60xx and E7018 electrodes.
7. Describe the procedure for testing basic joint welds.

10.09 TASK: WELD BASIC JOINTS IN VERTICAL POSITION (3G AND 3F)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, E60xx and E7018 electrodes, necessary tools and materials, and personal safety equipment, weld basic joints in the vertical position (3G and 3F) to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Layout mild steel coupons to form fillet and groove welds in the vertical position.
3. Prepare the surfaces for welding.
4. Describe filler material, amperage setting, rod angles, and speed of travel when welding in the vertical position.
5. Describe tacking procedures when welding in the vertical position.
6. Weld the five basic joints in the vertical position using E60xx and E7018 electrodes.
7. Describe the procedure for testing basic joint welds.

10.10 TASK: WELD BASIC JOINTS IN OVERHEAD POSITION (4G AND 4F)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, E60xx and E7018 electrodes, necessary tools and materials, and personal safety equipment, weld basic joints in the overhead position (4G and 4F) to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precaution when using S.M.A.W. equipment.
2. Layout mild steel coupons to form fillet and groove welds in the overhead position.
3. Prepare the surfaces for welding.
4. Describe filler material, amperage setting, rod angles, and speed of travel when welding in the overhead position.
5. Describe tacking procedures when welding in the overhead position.
6. Weld the five basic joints in the overhead position using E60xx and E7018 electrodes.
7. Describe the procedure for testing basic joint welds.

10.11 TASK: WELD CAST IRON

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, electrodes, necessary tools and materials, and personal safety equipment, weld cast iron to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Discuss problems encountered when welding cast iron.
3. Select and layout coupons for cast iron welding.
4. Prepare surfaces for welding.

5. Describe filler material, rod angles, and speed of travel when welding cast iron.
6. Describe procedure for setting amperage according to plate thickness and electrode diameter when welding cast iron.
7. Describe tacking/fitup procedure for welding cast iron.
8. Weld cast iron to standard given.
9. Describe the procedure for testing cast iron welds.

10.12 TASK: WELD ALLOY STEELS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, electrodes, necessary tools and materials, and personal safety equipment, weld alloy steels to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Explain methods to correctly identify alloy steels.
3. Describe the characteristics of alloy steels.
4. Explain the use of alloy steels in welding.
5. Discuss problems encountered when welding alloy steels.
6. Select and layout coupons for alloy steel welding.
7. Prepare surfaces for welding.
8. Describe filler material, rod angles, and speed of travel when welding alloy steels.
9. Describe procedure for setting amperage according to plate thickness and electrode diameter when welding alloy steels.
10. Describe tacking/fitup procedure for welding alloy steels.
11. Weld alloy steels to standard given.
12. Describe procedure for testing alloy steel welds.

10.13 TASK: BUILDUP SHAFT OR ROUND SURFACE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, shielded metal arc welding equipment, electrodes, necessary tools and materials, and personal safety equipment, buildup shaft or round surfaces to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Discuss problems encountered when welding shaft or round surfaces.
3. Select and layout coupons for buildup shaft or round surfacing.
4. Prepare surfaces for welding.
5. Describe filler material, rod angles, and speed of travel when welding buildup shafts or round surfaces.
6. Describe procedure for setting amperage according to plate thickness and electrode diameter when welding buildup shafts or round surfaces.
7. Describe fitup procedure for buildup shafts or round surfaces.
8. Weld buildup shafts or round surfaces.
9. Describe procedure for testing buildup shaft or round surface welding.

10.14 TASK: WELD ALUMINUM

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, electrodes, necessary tools and materials, and personal safety equipment, weld aluminum to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Discuss problems encountered when welding aluminum.
3. Select and layout coupons for aluminum welding.
4. Prepare surfaces for welding.
5. Describe filler material, rod angles, and speed of travel when welding aluminum.
6. Describe procedure for setting amperage according to plate thickness and electrode diameter when welding aluminum.
7. Describe fitup procedure for welding aluminum.
8. Weld aluminum to standard given.
9. Describe procedure for testing aluminum welds.

10.15 TASK: HARD SURFACE METALS WITH S.M.A.W.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, shielded metal arc welding equipment, electrodes, necessary tools and materials, and personal safety equipment, hard surface metals to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using S.M.A.W. equipment.
2. Discuss applications for hard surfacing (abrasion, impact, etc.).
3. Discuss problems encountered when hard surfacing metals.
4. Select and layout pieces for hard surfacing.
5. Prepare surfaces for hard surfacing.
6. Describe filler material, rod angles, and speed of travel when hard surfacing metal.
7. Describe procedure for setting amperage according to plate thickness and electrode diameter when hard surfacing metal.
8. Hard surface metal to standard given.
9. Describe procedure for testing hard surface welds.

10.16 TASK: SET UP A GAS TUNGSTEN ARC WELDER

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, tungsten arc welding equipment, operating manuals, necessary tools and materials, and personal safety equipment, set up a gas tungsten arc welder.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.T.A.W. equipment.
2. Identify components of a G.T.A.W. welding station and their functions.
3. Describe procedures for setting up a G.T.A.W. station.
4. List the steps for assembly and disassembly of a G.T.A.W. station.
5. Set up and adjust a gas tungsten arc welder.

10.17 TASK: SELECT AND PREPARE A TUNGSTEN ELECTRODE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, tungsten electrodes, manuals, tools and safety equipment, select and prepare a tungsten electrode.

ENABLING OBJECTIVES:

1. Explain safety precautions when preparing tungsten electrodes.
2. Match characteristics of four types of electrodes to their color codes.
3. Describe procedure for electrode tip shaping.
4. Explain the need for length-wise grinding of the electrode tip.
5. Select and prepare a tungsten electrode.

10.18 TASK: STRIKE AND MAINTAIN A G.T.A.W. ARC

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, tungsten arc welding equipment, electrodes, necessary tools and materials, and personal safety equipment, strike and maintain a G.T.A.W. arc.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.T.A.W. equipment.
2. Explain procedures for striking and maintaining an arc.
3. Strike and maintain a G.T.A.W. arc.

10.19 TASK: WELD MILD STEEL IN ALL POSITIONS (1F THRU 4F)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, tungsten arc welding equipment, filler rod, mild steel plate, flow meter and regulator, necessary tools and material, joint and weld specifications, and personal safety equipment, weld mild steel in all positions (1F thru 4F) to specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.T.A.W. equipment.
2. Describe procedures for laying out and welding in all positions.
3. Describe filler material, torch angle, and speed of travel when welding mild steel.

4. Describe procedure for tacking joints.
5. Lay out mild steel coupons to form joints in all positions.
6. Weld mild steel coupons to form joints in all positions.
7. Describe the procedure for testing mild steel joints.

10.20 TASK: WELD STAINLESS STEEL IN ALL POSITIONS (1G THRU 4G)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, tungsten arc welding equipment, filler rod, stainless steel plate, necessary tools and materials, joint and weld specifications, and personal safety equipment, weld joints on stainless steel in all positions (1G thru 4G) to specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.T.A.W. equipment.
2. Describe procedures for laying out and welding in all positions.
3. Describe filler material, torch angle, and speed of travel when welding stainless steel.
4. Discuss the problem of oxidation when welding stainless steel.
5. Describe carbide precipitation.
6. Classify types of stainless steel alloys by micro structure.
7. Describe procedure for tacking joints.
8. Lay out stainless steel coupons to form joints in all positions.
9. Weld stainless steel coupons to form joints in all positions.
10. Describe the procedure for testing stainless steel joints.

10.21 TASK: WELD ALUMINUM IN ALL POSITIONS (1G THRU 4G)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, tungsten arc welding equipment, filler rod, aluminum coupons, necessary tools and equipment, joint and weld specifications, and personal safety equipment, weld joints on aluminum in all positions (1G thru 4G) to specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.T.A.W. equipment.
2. Describe procedure for laying out and welding in all positions.
3. Describe filler material, torch angle, and speed of travel when welding aluminum.
4. Classify aluminum alloys by type.
5. Explain "hot cracking" as applied to aluminum alloys.
6. Describe procedure for tacking joints.
7. Lay out aluminum coupons to form joints in all positions.
8. Weld aluminum coupons to form joints in all positions.
9. Describe procedure for testing aluminum joints.

10.22 TASK: SET UP AND ADJUST G.M.A.W. AND F.C.A.W. EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, G.M.A.W. and F.C.A.W. equipment, demonstrations, and personal safety equipment, set up and adjust G.M.A.W. and F.C.A.W. equipment.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.M.A.W. and F.C.A.W. equipment.
2. Explain proper adjustment for voltage, amperage, and wire speed.
3. Discuss the G.M.A.W. and F.C.A.W. welding processes.
4. Set up G.M.A.W. and F.C.A.W. equipment.
5. Adjust G.M.A.W. and F.C.A.W. equipment.
6. Describe procedure for G.M.A.W. and F.C.A.W. shut down.

10.23 TASK: WELD WEAVE BEAD PATTERNS USING G.M.A.W. AND F.C.A.W.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, G.M.A.W. and F.C.A.W. equipment, necessary tools and materials, and personal safety equipment, weld weave bead patterns using G.M.A.W. and F.C.A.W., to industry standards.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.M.A.W. and F.C.A.W. equipment.
2. Discuss vertical down/vertical up patterns.
3. Discuss forehand and backhand methods of welding.
4. Prepare surfaces for welding.
5. Weld weave bead patterns in all positions.

10.24 TASK: WELD BASIC JOINTS IN FLAT, HORIZONTAL, AND VERTICAL POSITIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, G.M.A.W. and F.C.A.W. equipment, necessary tools and materials, and personal safety equipment, weld basic joints in flat, horizontal, and vertical positions using G.M.A.W. and F.C.A.W. equipment.

ENABLING OBJECTIVES:

1. Explain safety precautions when using G.M.A.W. and F.C.A.W. equipment.
2. Discuss welding joints in the flat, horizontal, and vertical positions.
3. Explain advantages of forehand and backhand welding.
4. Prepare surfaces for welding.
5. Weld basic joints in flat, horizontal, and vertical positions.

10.25 TASK: SET UP AIR CARBON ARC CUTTING EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, air carbon arc cutting equipment, necessary tools and materials, and personal safety equipment, set up air carbon cutting equipment.

ENABLING OBJECTIVES:

1. Explain safety precautions when using air carbon cutting equipment.
2. Select proper safety equipment.
3. Identify the parts of an air arc gun.
4. Identify electrodes and their polarity.
5. Select an electrode.
6. Set up an air carbon arc cutter.
7. Explain shut down procedures for an air carbon arc cutter.

10.26 TASK: GOUGE, CUT, AND PIERCE METALS USING AIR CARBON ARC

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, air carbon arc cutting equipment, necessary tools and materials, and personal safety equipment, gouge, cut, and pierce metal using air carbon arc.

ENABLING OBJECTIVES:

1. Explain safety precautions when using air carbon arc cutting equipment.
2. Classify ferrous and non-ferrous metals by:
 - a. Appearance test
 - b. Magnetic test
 - c. Flame test
 - d. Chisel test
 - e. Spark test
3. Gouge ferrous and non-ferrous metals.
4. Cut ferrous and non-ferrous metals.
5. Pierce ferrous and non-ferrous metals.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 11

**DEMONSTRATE KNOWLEDGE OF THE
ELEMENTS OF ELECTRICITY AND
ELECTRONICS**

MODULE 11 - DEMONSTRATE KNOWLEDGE OF ELECTRICITY AND ELECTRONICS

This is one of a series of modules which comprise the Idaho Curriculum Guide for Industrial Mechanics. Each module contains a listing of the tasks, performance objectives, and enabling objectives required to enable a student to achieve competency in a specific system or field of study within the industrial mechanics occupational field. The numbering of these modules is not intended to dictate an order of instruction or scheduling. The order in which these modules may be taught is determined by each institution and its instructors.

Each task describes an occupational activity which will result in a finished process or product. The tasks listed in each module represent the basic activities required of each student to demonstrate entry level competence for that specific system or field of study within the industrial mechanics occupation. Individual records of student performance in completing the tasks listed within each module should be maintained.

Although some provision is made for basic mathematics and communication skills within this guide, they may not be adequate to meet the needs of individual students. Counseling, guidance, and diagnostic test results may indicate a need for further preparation in these areas. In such cases, instructors are encouraged to utilize the resources and personnel within the institution to improve or complement the instructional process.

The benefits to students and institutions derived from this curriculum guide should be considerable. Articulation of students from secondary to post-secondary programs will be aided through the use of a single curriculum guide. The guide provides a tool for evaluation of local curriculum and programs. The guide may be used in a flexible manner to assure that industrial mechanics programs meet the needs of local business and industry.

It is the goal of this program guide to provide a level of instruction which will impart entry level employment skills. Students should be carefully counseled on the importance of attaining competency in the tasks assigned. As in virtually all occupations today industrial mechanics will require periodic up-dating and review in the future. It is important that each student understand that meeting the program standards is essential not only to obtain employment today but also to have a base upon which to retain employment in the future.

IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 11 - DEMONSTRATE KNOWLEDGE OF THE ELEMENTS OF ELECTRICITY AND ELECTRONICS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 11.01 | Define common terms used in electricity and electronics. |
| E | 11.02 | Discuss the National Electrical Code. |
| E | 11.03 | Explain the nature of static electricity. |
| E | 11.04 | Explain methods used to measure and control static electricity. |
| E | 11.05 | Explain the theory of magnetism. |
| E | 11.06 | Describe the industrial uses of magnets and electromagnets. |
| E | 11.07 | Explain the purpose and use of transformers. |
| E | 11.08 | Explain Ohm's Law. |
| E | 11.09 | Use instruments which measure current, resistance, and potential difference. |
| E | 11.10 | Explain the fundamentals of DC circuits. |
| E | 11.11 | Explain the use of DC circuits in motors and generators. |
| E | 11.12 | Explain the use and function of electrical and electronic control equipment. |
| E | 11.13 | Discuss programmable controllers. |
| E | 11.14 | Explain the differences between AC and DC circuits. |
| E | 11.15 | Demonstrate knowledge of the instruments used to measure electrical circuits. |
| E | 11.16 | Measure load in three phase circuits. |
| E | 11.17 | Install electric motors. |
| E | 11.18 | Demonstrate knowledge of troubleshooting procedures for electric circuits and control systems. |
| E | 11.19 | Troubleshoot DC motors. |
| E | 11.20 | Troubleshoot AC motors. |
| E | 11.21 | Troubleshoot lighting systems. |

**DEMONSTRATE KNOWLEDGE OF THE ELEMENTS OF ELECTRICITY AND
ELECTRONICS**

11.01 TASK: DEFINE COMMON TERMS USED IN ELECTRICITY AND ELECTRONICS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, define common terms used in electricity and electronics.

ENABLING OBJECTIVES:

1. Match a list of electricity and electronic terms with a corresponding list of definitions.

11.02 TASK: DISCUSS THE NATIONAL ELECTRIC CODE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and the National Electric Code, describe verbally or write in a short essay on an assigned section of the National Electric Code.

ENABLING OBJECTIVES:

1. Correlate assigned readings with proper portions of the Code.
2. Describe Code contents in writing or orally.

11.03 TASK: EXPLAIN THE NATURE OF STATIC ELECTRICITY

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and demonstration, explain the nature of static electricity.

ENABLING OBJECTIVES:

1. Discuss static electricity.
2. Demonstrate static electricity.
3. Explain the role of polarity.

11.04 TASK: EXPLAIN METHODS USED TO MEASURE AND CONTROL STATIC ELECTRICITY

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions and demonstration, explain methods used to measure and control static electricity.

ENABLING OBJECTIVES:

1. Explain the safety concerns regarding static electricity shock.
2. Demonstrate utilization of static phenomena components.
3. Describe undesirable static phenomena (electronics).
4. Explain use of static electricity measuring equipment.

11.05 TASK: EXPLAIN THE THEORY OF MAGNETISM

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, explain the theory of magnetism.

ENABLING OBJECTIVES:

1. Explain magnetic effects, in a safe and prudent manner.
2. Explain magnetic concepts using test equipment.

11.06 TASK: DESCRIBE THE INDUSTRIAL USES OF MAGNETS AND ELECTROMAGNETS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, solenoids, and electromagnets, describe the industrial uses of magnets and electromagnets.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with electromagnets.
2. Wire and prepare a suitable demonstration.
3. Observe electromagnetic operations.
4. Describe associated components of electromagnetic effect in a safe manner.

11.07 TASK: EXPLAIN THE PURPOSE AND USE OF TRANSFORMERS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, transformers, and necessary materials, explain the purpose and use of a transformer.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with transformers.
2. Describe installation and wiring of a transformer.
3. Explain primary and secondary relationships associated with transformers.
4. Identify a schematic illustration of a transformer.
5. Locate and identify an industrial control transformer.

11.08 TASK: EXPLAIN OHM'S LAW

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, explain OHM's Law.

ENABLING OBJECTIVES:

1. Discuss electrical resistance.
2. Describe the uses of an ohmmeter.
3. Explain Ohm's Law with a lab demonstration.

11.09 TASK: USE INSTRUMENTS WHICH MEASURE CURRENT, RESISTANCE, AND POTENTIAL DIFFERENCE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and appropriate meters, demonstrate test meter competence.

ENABLING OBJECTIVES:

1. Explain safety precautions when using electrical measuring instruments.
2. Select a meter.
3. Adjust the meter.
4. Measure current.
5. Measure volts.
6. Measure resistance.
7. Disassemble and deactivate a meter.

11.10 TASK: EXPLAIN THE FUNDAMENTALS OF D.C. CIRCUITS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and D.C. circuit demonstration equipment, explain the fundamentals of D.C. circuits.

ENABLING OBJECTIVES:

1. Explain the safety precautions when operating D.C. circuits.
2. Describe a D.C. circuit.
3. Observe an operating D.C. circuit.
4. Explain fundamentals of a D.C. circuit.

11.11 TASK: EXPLAIN THE USE OF DC CIRCUITS IN MOTORS AND GENERATORS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, and reference materials, explain the use of D.C. circuits in motors and generators.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with D.C. motors and generators.
2. Identify D.C. motors and generators by viewing schematics.
3. Explain performance of series, shunt, and compound wound motors.
4. Explain output characteristics of shunt or compound generators.

11.12 TASK: EXPLAIN THE USE AND FUNCTION OF ELECTRICAL AND ELECTRONIC CONTROL EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, reference materials, and necessary equipment, explain the use and function of electrical and electronic control equipment.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with electric control equipment.
2. Describe the function of:
 - a. Electro mechanical and solid state relays

- b. Rheostats
 - c. Overload relays
 - d. Speed control devices.
- 3. Identify schematic symbols.
- 4. Explain operation of selected devices.

11.13 TASK: DISCUSS PROGRAMMABLE CONTROLLERS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and necessary training aids, discuss programmable controllers.

ENABLING OBJECTIVES:

- 1. Explain safety precautions when working with programmable controllers.
- 2. Identify selected controllers by type.
- 3. Discuss programmable controllers.

11.14 TASK: EXPLAIN THE DIFFERENCES BETWEEN A.C. & D.C. CIRCUITS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, schematics, and necessary equipment, explain the differences between A.C. & D.C. circuits.

ENABLING OBJECTIVES:

- 1. Identify A.C. circuits on schematics.
- 2. Identify D.C. circuits on schematics.
- 3. Explain the differences between A.C. & D.C. circuits.

11.15 TASK: DEMONSTRATE KNOWLEDGE OF THE INSTRUMENTS USED TO MEASURE ELECTRICAL CIRCUITS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, necessary test instruments, and electrical circuits, demonstrate knowledge of the instruments used to measure electrical circuits.

ENABLING OBJECTIVES:

- 1. Explain safety precautions when measuring electrical circuits.
- 2. Describe the functions and components of:
 - a. Simpson 260 or equivalent, and
 - b. Sperry Snap Nine or equivalent.
- 3. Measure selected voltages.
- 4. Measure selected circuits for opens and shorts.
- 5. Measure selected circuits for amps.

11.16 TASK: MEASURE LOAD IN THREE-PHASE CIRCUITS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, measuring devices, necessary materials, and several types of three-phase AC induction devices, measure load in three-phase circuits.

ENABLING OBJECTIVES:

1. Explain safety precautions when measuring three-phase circuits.
2. Measure amp draw in each phase using a snap-around test meter.
3. Identify three-phase devices by nameplate coding.
4. Size conductors as required.
5. Determine proper overcurrent protection.
6. Select proper controlling components.
7. Measure horsepower, calculate torque and speed.

11.17 TASK: INSTALL ELECTRIC MOTORS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, schematics, and electric motors, install selected single and three phase motors.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing electric motors.
2. Identify selected motors by type.
3. Install electric motors using a schematic or ladder diagram.

11.18 TASK: DEMONSTRATE KNOWLEDGE OF TROUBLESHOOTING FOR ELECTRICAL CIRCUITS AND CONTROL SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a testing stand, and necessary test materials, demonstrate knowledge of troubleshooting for electrical circuits and control systems.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting electrical systems.
2. Analyze schematics or ladder diagrams.
3. Utilize test meters for troubleshooting.
4. Identify shorts and open circuits.
5. Test operating motors for running load.
6. Evaluate name plate data.

11.19 TASK: TROUBLESHOOT D.C. MOTORS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, testing materials, and necessary equipment, troubleshoot and service D.C. motors.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting D.C. motors.
2. Identify by schematic or name plate data, motor type.
3. Test D.C. motor operating performance under load with meters.
4. Perform preventive maintenance checks on brushes, rotors, and armatures.
5. Test field windings.

11.20 TASK: TROUBLESHOOT A.C. MOTORS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, testing materials, and necessary equipment, troubleshoot and service A.C. motors.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting A.C. motors.
2. Identify by schematic or name plate data, motor type.
3. Test A.C. motor operating performance under load with meters.
4. Troubleshoot A.C. motor capacitors, centrifugal switches, brushes, and armatures.

11.21 TASK: TROUBLESHOOT LIGHTING SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, testing materials, and lighting systems, troubleshoot and service lighting systems.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting lighting systems.
2. Identify by type, selected lighting systems.
3. Determine frequency and duration of use and ambient operating temperatures.
4. Evaluate starter conditions by lamp performance.
5. Troubleshoot lighting systems.

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

MODULE 12

**DEMONSTRATE KNOWLEDGE OF THE
ELEMENTS OF MECHANICS**

MODULE 12 - DEMONSTRATE KNOWLEDGE OF ELEMENTS OF MECHANICS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 12 - DEMONSTRATE KNOWLEDGE OF THE ELEMENTS OF MECHANICS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 12.01 | Demonstrate an understanding of measuring systems and ratios. |
| E | 12.02 | Explain working forces of torque, tension, and compression. |
| E | 12.03 | Explain the laws of motion. |
| E | 12.04 | Explain how to calculate work. |
| E | 12.05 | Explain the function of simple machines including levers, inclined plane, wedge wheel and axle, pulley and screw. |
| E | 12.06 | Explain the types of power transfer. |
| E | 12.07 | Explain the laws of friction. |

DEMONSTRATE KNOWLEDGE OF THE ELEMENTS OF MECHANICS

12.01 TASK: DEMONSTRATE AN UNDERSTANDING OF MEASURING SYSTEMS AND RATIOS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, tools, and scales, demonstrate an understanding of measuring systems and ratios.

ENABLING OBJECTIVES:

1. **Discuss types of measuring systems.**
2. **Perform measuring using several types of measuring systems.**
3. **Discuss ratios.**
4. **Apply ratios.**
5. **Combine ratios and measuring techniques.**

12.02 TASK: EXPLAIN WORKING FORCES OF TORQUE, TENSION, AND COMPRESSION

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, manuals, and diagrams, explain working forces of torque, tension, and compression.

ENABLING OBJECTIVES:

1. **Discuss and explain torque, tension, and compression.**
2. **Describe examples of torque, tension, and compression.**

12.03 TASK: EXPLAIN THE LAWS OF MOTION

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and demonstration, explain the laws of motion.

ENABLING OBJECTIVES:

1. **Identify different motions.**
2. **Discuss and explain laws of motion.**

12.04 TASK: EXPLAIN HOW TO CALCULATE WORK

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals and text books, explain how to calculate work.

ENABLING OBJECTIVES:

1. **Discuss work formulas.**
2. **Perform work calculations.**

12.05 TASK: EXPLAIN THE FUNCTION OF SIMPLE MACHINES INCLUDING LEVERS, INCLINE PLANE, WEDGE WHEEL AND AXLE, PULLEY AND SCREW

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, tools, and necessary equipment, explain the function of simple machines.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with simple machines.
2. Identify:
 - a. a lever,
 - b. an incline plane,
 - c. a wedge wheel,
 - d. an axle,
 - e. a pulley, and
 - f. a screw.
3. Discuss the functions of each simple machine.

12.06 TASK: EXPLAIN THE TYPES OF POWER TRANSFER

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, motors, and power transfer components, explain types of power transfer.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with power transfer components.
2. Identify power transfer devices.
3. Explain power transfer systems.
4. Demonstrate various power sources.

12.07 TASK: EXPLAIN THE LAWS OF FRICTION

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, explain the laws of friction.

ENABLING OBJECTIVES:

1. Define friction.
2. Differentiate between static and kinetic friction.
3. Discuss the effects of friction.
4. Explain the laws of friction.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 13

**DEMONSTRATE THE USE AND APPLICATION
OF LUBRICANTS**

MODULE 13 - DEMONSTRATE USE AND APPLICATION OF LUBRICANTS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 13 - DEMONSTRATE THE USE AND APPLICATION OF LUBRICANTS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 13.01 | Explain the function of lubricants. |
| E | 13.02 | Explain the properties of oil lubricants and factors determining the selection of lubricants. |
| E | 13.03 | Identify the types and functions of lubricant additives. |
| E | 13.04 | Describe the types and functions of circulating oils. |
| R | 13.05 | Describe lubricating systems, including the charts and methods used. |
| E | 13.06 | Demonstrate proper grease application. |
| E | 13.07 | Demonstrate proper lubricant storage and handling. |
| E | 13.08 | Lubricate industrial equipment. |

DEMONSTRATE THE USE AND APPLICATION OF LUBRICANTS

13.01 TASK: EXPLAIN THE USE AND APPLICATION OF LUBRICANTS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, explain the function of lubricants.

ENABLING OBJECTIVES:

1. Explain how lubricants protect machine parts from rust and corrosion.
2. Explain how lubricants resist foaming and oxidation.
3. Explain how lubricants are capable of separating readily from air, water, and other contaminants.
4. Explain how lubricants act as a seal between parts.
5. Explain how lubricants help to disperse heat.

13.02 TASK: EXPLAIN THE PROPERTIES OF OIL LUBRICANTS AND FACTORS DETERMINING THE SELECTION OF LUBRICANTS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, explain the properties of oil lubricants and factors determining the selection of lubricants.

ENABLING OBJECTIVES:

1. Explain grading of oils.
2. Explain viscosity numbers.
3. Explain oil service classifications.

13.03 TASK: IDENTIFY THE TYPES AND FUNCTIONS OF LUBRICANT ADDITIVES

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, identify the types and functions of lubricant additives.

ENABLING OBJECTIVES:

1. Explain viscosity index improver.
2. Explain oxidation inhibitors.
3. Explain foaming resistance.
4. Explain detergent dispersants.

13.04 TASK: DESCRIBE THE TYPES AND FUNCTIONS OF CIRCULATING OILS

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, describe the types and functions of circulating oils.

ENABLING OBJECTIVES:

1. Describe types of circulating oils.
2. Describe uses of circulating oils.

13.05 TASK: DESCRIBE LUBRICATING SYSTEMS, INCLUDING THE CHARTS AND METHODS USED

LEVEL E PERFORMANCE OBJECTIVES: Given instruction and necessary charts, describe lubricating systems, including the charts and methods used.

ENABLING OBJECTIVES:

1. Describe a splash type lubricating system.
2. Describe a pressure feed system.
3. Describe a combination splash and pressure system.

13.06 TASK: DEMONSTRATE PROPER GREASE APPLICATION

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, a lubrication guide, and necessary equipment, demonstrate proper grease application.

ENABLING OBJECTIVES:

1. Explain safety precautions when greasing equipment.
2. Demonstrate use of a lubrication guide.
3. Demonstrate use of greasing equipment.

13.07 TASK: DEMONSTRATE PROPER LUBRICANT STORAGE AND HANDLING

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, lubricants, and necessary materials, demonstrate proper lubricant storage and handling.

ENABLING OBJECTIVES:

1. Explain safety precautions when handling lubricants.
2. Discuss lubricant storage.
3. Describe how to avoid lubricant contamination by water and other substances.
3. Demonstrate proper lubricant storage and handling.

13.08 TASK: LUBRICATE INDUSTRIAL EQUIPMENT

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, charts, lubricants, and industrial equipment, lubricate the equipment to specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions when lubricating industrial equipment.
2. Demonstrate use of lubrication instructions.
3. Demonstrate lubrication of industrial equipment.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 14

INSTALL AND MAINTAIN DRIVE COMPONENTS

MODULE 14 - INSTALL AND MAINTAIN DRIVE COMPONENTS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 14 - INSTALL AND MAINTAIN DRIVE COMPONENTS

The student will be able to:

LEVEL

- E 14.01 Install a solid coupling.**
- E 14.02 Install a jaw coupling.**
- E 14.03 Install a molded rubber coupling.**
- E 14.04 Install a chain type coupling.**
- E 14.05 Install V-belts and adjust tension.**
- E 14.06 Install and adjust a V-belt with manually adjustable sheaves.**
- E 14.07 Install a V-belt with spring loaded adjustable sheaves.**
- E 14.08 Describe chain drive systems.**
- E 14.09 Explain the function of speed reducers.**
- E 14.10 Explain the function of gears and variable speed reducers.**
- E 14.11 Install and align shafts.**
- E 14.12 Mount drive sprockets and chains.**
- E 14.13 Mount sheaves and pulleys.**
- E 14.14 Mount and align gears on open gear drives.**
- E 14.15 Install a mechanical clutch system.**
- E 14.16 Install adjustable speed drives.**
- E 14.17 Troubleshoot adjustable speed drives.**
- E 14.18 Explain the operation of fluid couplings.**
- E 14.19 Install fluid couplings.**
- E 14.20 Install torque converters.**
- E 14.21 Perform preventive maintenance on drive components.**

INSTALL AND MAINTAIN DRIVE COMPONENTS

14.01 TASK: INSTALL A SOLID COUPLING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a solid coupling, service manuals, necessary tools, and gauges, install a solid coupling and check run-out.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing couplings.
2. Identify a solid (or rigid) coupling.
3. Explain solid coupling operation.
4. Align a solid coupling and make a run-out check.

14.02 TASK: INSTALL A JAW COUPLING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a jaw coupling, service manuals, special alignment tools and gauges, install a jaw coupling.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing a jaw coupling.
2. Identify a Jaw coupling.
3. Explain functions of a jaw coupling.
4. Install a jaw coupling.
5. Align a jaw coupling, and make a run-out check.

14.03 TASK: INSTALL A MOLDED RUBBER COUPLING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a shaft, a molded rubber coupling, service manuals, special tools and gauges, install a molded rubber coupling.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing couplings.
2. Discuss the importance of aligning a coupling.
3. Discuss function and use of molded rubber couplings.
4. Install a molded rubber coupling.
5. Align a molded rubber coupling and do run-out check.

14.04 TASK: INSTALL A CHAIN TYPE COUPLING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a chain type coupling, manuals for maintenance and alignment, necessary tools, dial indicators, and gauges, install a chain type coupling.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing chain couplings.
2. Identify chain type couplings.
3. Explain operation of chain type couplings.
4. Install a chain type coupling.
5. Align a chain type coupling.
6. Lubricate a chain type coupling.

14.05 TASK: INSTALL V-BELTS AND ADJUST TENSION

LEVEL E: **PERFORMANCE OBJECTIVE:** Given instruction, a v-belt, tools, service manual, and necessary materials, install and align a v-belt and adjust tension.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with v-belts.
2. Discuss types and functions of v-belts.
3. Adjust tension properly "feel" or with a tension gauge.

14.06 TASK: INSTALL AND ADJUST A V-BELT WITH MANUALLY ADJUSTABLE SHEAVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a v-belt with manually adjustable sheave, necessary tools and equipment, install and adjust a v-belt with manually adjustable sheaves.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with v-belts.
2. Discuss function and operation of v-belts with manually adjustable sheaves.
3. Install and align a v-belt with manually adjustable sheaves.
4. Manually adjust sheaves.
5. Discuss v-belt damage due to improper installation.

14.07 TASK: INSTALL A V-BELT WITH SPRING LOADED ADJUSTABLE SHEAVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a v-belt with spring loaded adjustable sheaves, necessary tools and manuals, install a v-belt with adjustable spring loaded sheaves.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with v-belts.
2. Discuss function and operation of v-belts with spring loaded adjustable sheaves.
3. Install and align a v-belt with spring loaded adjustable sheaves.
4. Adjust sheaves with tension shaft nut.
5. Discuss v-belt damage due to improper installation.

14.08 TASK: DESCRIBE CHAIN DRIVE SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and necessary materials, describe chain drive systems.

ENABLING OBJECTIVES:

1. Identify a chain drive system.
2. Describe chain drive system advantages.

14.09 TASK: EXPLAIN THE FUNCTION OF SPEED REDUCERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a speed reducer, and service manuals, explain the function of speed reducers.

ENABLING OBJECTIVES:

1. Identify a speed reducer.
2. Explain the function of a speed reducer.

14.10 TASK: EXPLAIN THE FUNCTION OF GEARS AND VARIABLE SPEED REDUCERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and service manuals, explain the function of gears and variable speed reducers.

ENABLING OBJECTIVES:

1. Identify gears and speed reducers.
2. Discuss the correct formula of gears in respect to correct formula of reducers.

14.11 TASK: INSTALL AND ALIGN SHAFTS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a shaft, and necessary tools and equipment, install and align a shaft.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing shafts.
2. Identify various sizes (diameter) of shafts.
3. Install and align a shaft.

14.12 TASK: MOUNT DRIVE SPROCKETS AND CHAINS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, drive sprockets and chain, necessary tools, and repair manual, mount a drive sprocket and chain.

ENABLING OBJECTIVES:

1. Explain safety precautions when mounting sprockets and chains.
2. Identify the types of sprockets and drives.
3. Discuss the different types of tolerances and tooth form.
4. Discuss the different types of chain pitch and links.
5. Explain necessary maintenance and lubrication involved.
6. Mount drive sprockets and chains.

14.13 TASK: MOUNT SHEAVES AND PULLEYS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, sheaves and pulleys, tools, and references, mount sheaves and pulleys.

ENABLING OBJECTIVES:

1. Explain safety precautions when mounting sheaves and pulleys.
2. Explain the difference between sheaves and pulleys.
3. Discuss sheave and pulley wear characteristics.
4. Mount sheaves and pulleys.
5. Discuss lubrication of sheaves and pulleys.

14.14 TASK: MOUNT AND ALIGN GEARS ON OPEN GEAR DRIVES

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, tools, manuals, and gears, mount and align gears on open gear drives.

ENABLING OBJECTIVES:

1. Explain safety precautions when mounting gears on open gear drives.
2. Discuss the types and functions of gears.
3. Explain proper back lash.
4. Discuss proper adjustments.
5. Discuss proper lubrication.
6. Mount and align a gear on an open gear drive.

14.15 TASK: INSTALL A MECHANICAL CLUTCH SYSTEM

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a mechanical clutch system, service and maintenance manuals, tools and gauges, install a mechanical clutch system.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing a mechanical clutch system.
2. Identify a mechanical clutch system.
3. Explain how a mechanical clutch system works.
4. Discuss the importance of proper lubrication.
5. Explain the importance of following the manuals when assembling the clutch system.
6. Install a clutch assembly.

14.16 TASK: INSTALL ADJUSTABLE SPEED DRIVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, adjustable speed drives, formula manual, service manual, and tools, install an adjustable speed drive.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing adjustable speed drives.
2. Identify an adjustable speed drive.
3. Explain the function of an adjustable speed drive.
4. Discuss the use of manuals to find proper speed.
5. Discuss lubrication of adjustable speed drives.

14.17 TASK: TROUBLESHOOT ADJUSTABLE SPEED DRIVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, adjustable speed drives, tools, charts, and manuals, troubleshoot an adjustable speed drive.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting speed drives.
2. Identify an adjustable speed drive.
3. Discuss the functions and operation of a speed drive.
4. Demonstrate with a timing light and charts how to troubleshoot an adjustable speed drive.

14.18 TASK: EXPLAIN THE OPERATION OF FLUID COUPLINGS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and a fluid coupling, explain the operation of fluid couplings.

ENABLING OBJECTIVE:

1. Identify a fluid coupling.
2. Explain the operation of a fluid coupling.
3. Discuss the use of fluid couplings in industry.
4. Discuss the use of fluid couplings in vehicles.

14.19 TASK: INSTALL A FLUID COUPLING

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a fluid coupling, tools, and manuals, install a fluid coupling.

ENABLING OBJECTIVE:

1. Explain safety precautions when installing a fluid coupling.
2. Install a fluid coupling.

14.20 TASK: INSTALL A TORQUE CONVERTER

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a torque converter, tools, and manuals, install a torque converter.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing a torque converter.
2. Discuss types of torque converters.
3. Install a torque converter in an industrial machine.

14.21 TASK: PERFORM PREVENTIVE MAINTENANCE ON DRIVE COMPONENTS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, drive systems, and a schedule and maintenance sequence, perform preventive maintenance on drive components.

ENABLING OBJECTIVES:

1. Explain safety precautions when performing preventative maintenance on drive components.
2. Inspect drive components on:
 - a. couplings,
 - b. bearings,
 - c. U-joints,
 - d. drive lines, and
 - e. alignment and phasing.
3. Lubricate drive components.
4. Perform preventive maintenance on belt, gear, and chain drive components.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 15

**INSTALL, INSPECT AND REPAIR OR REPLACE
BEARINGS**

MODULE 15 - INSTALL, INSPECT AND REPAIR OR REPLACE BEARINGS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 15 - INSTALL, INSPECT, AND REPAIR OR REPLACE BEARINGS

The student will be able to:

LEVEL

- E 15.01 Identify common bearing types and their applications.**
- E 15.02 Install anti-friction bearings.**
- E 15.03 Identify specialized bearings and their applications.**
- E 15.04 Identify and select bearing seals.**
- E 15.05 List rules for good bearing lubrication.**
- E 15.06 Explain bearing load, wear patterns, & maintenance.**
- E 15.07 Demonstrate use of cross-reference manuals in bearing maintenance and repair.**
- E 15.08 Explain the use of bearing forecast maintenance systems.**
- E 15.09 Remove, inspect, and replace a plain journal bearing.**

INSTALL, INSPECT AND REPAIR OR REPLACE BEARINGS

15.01 TASK: IDENTIFY COMMON BEARING TYPES AND THEIR APPLICATIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, bearing samples of each common bearing type, and necessary references, identify common bearing types and their applications.

ENABLING OBJECTIVE:

1. **Identify each common bearing type.**
2. **Discuss the construction of each common bearing.**
3. **Explain application of each bearing type.**

15.02 TASK: INSTALL ANTI-FRICTION BEARINGS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a selection of anti-friction bearings, tools, and service manuals, install anti-friction bearings.

ENABLING OBJECTIVE:

1. **Explain the safety precautions when installing anti-friction bearings.**
2. **Identify each anti-friction bearing type.**
3. **Discuss the installation procedure for each type of bearing.**
4. **Mount, square, and align an anti-friction bearing.**

15.03 TASK: IDENTIFY SPECIALIZED BEARINGS AND THEIR APPLICATIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, examples of specialized bearings, and service manuals, identify specialized bearings and their applications.

ENABLING OBJECTIVES:

1. **Identify: thrust bearings; self-aligning bearings; non-metallic bearings; and hydrostatic bearings.**
2. **Discuss the characteristics of each bearing.**
3. **Discuss the application of each bearing.**

15.04 TASK: IDENTIFY AND SELECT BEARING SEALS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and bearing seal information guides, identify and select the bearing seals.

ENABLING OBJECTIVES:

1. **Identify each bearing seal type.**
2. **Discuss types of sealed bearings.**
3. **Discuss application for each bearing seal type.**
4. **Select a bearing seal for a specific application.**

15.05 TASK: LIST RULES FOR GOOD BEARING LUBRICATION

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and bearing information study guides, list rules for good bearing lubrication.

ENABLING OBJECTIVES:

1. Discuss the need for bearing lubrication.
2. Discuss types of bearing lubricants.
3. List rules for good bearing lubrication

15.06 TASK: EXPLAIN BEARING LOAD, WEAR PATTERNS, & MAINTENANCE

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and bearing information study guides, explain bearing load, wear patterns, and maintenance.

ENABLING OBJECTIVES:

1. Explain radial load.
2. Explain thrust load.
3. Explain angular load.
4. Discuss the load accepted by each bearing type.
5. Explain normal and abnormal bearing wear patterns.
6. Explain maintenance procedures for each type of bearing.

15.07 TASK: DEMONSTRATE THE USE OF CROSS-REFERENCE MANUALS IN BEARING MAINTENANCE AND REPAIR

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and bearing cross-reference manuals, demonstrate the use of cross-reference manuals in bearing maintenance and repair.

ENABLING OBJECTIVES:

1. Discuss how bearing numbers are cross-referenced.
2. Explain how bearings of different manufacturers are used in the same application.
3. Identify a bearing manufacturer's number then cross reference it to another manufacturer's number.

15.08 TASK: EXPLAIN THE USE OF BEARING FORECAST MAINTENANCE SYSTEMS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction and a bearing forecast maintenance service manual, explain the use of bearing forecast maintenance systems.

ENABLING OBJECTIVES:

- 1. Explain bearing forecast maintenance.**
- 2. Discuss the benefits of bearing forecast maintenance systems.**
- 3. Explain scheduled bearing maintenance for plain journal type bearings for diesel engines.**
- 4. Explain scheduled bearing maintenance for roller and ball bearings.**

15.09 TASK: REMOVE, INSPECT, AND REPLACE A PLAIN JOURNAL BEARING

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a mounted plain journal bearing, tools, service manuals, and re-useable bearing guidelines, remove, inspect, and replace a plain journal bearing.

ENABLING OBJECTIVES:

- 1. Explain the safety precautions when removing and replacing journal bearings.**
- 2. Discuss removal procedure for plain journal bearings.**
- 3. Explain procedure for inspection of used bearings.**
- 4. Demonstrate the procedure to remove a plain journal bearing.**
- 5. Discuss the decision making process for use or replacement of used bearings.**
- 6. Explain the correct bearing lubrication methods during assembly.**
- 7. Explain the bearing installation precautions.**
- 8. Remove, inspect, and replace a plain journal bearing.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

MODULE 16

PERFORM PUMP MAINTENANCE AND REPAIR

MODULE 16 - PERFORM PUMP MAINTENANCE AND REPAIR

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 16 - PERFORM PUMP MAINTENANCE AND REPAIR

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| R | 16.01 | Determine pump capacity and system requirements. |
| E | 16.02 | Identify packing and seal requirements. |
| E | 16.03 | Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating and metering pumps. |
| E | 16.04 | Disassemble and reassemble a pump. |
| E | 16.05 | Perform pump maintenance. |

PERFORM PUMP MAINTENANCE AND REPAIR

16.01 TASK: DETERMINE PUMP CAPACITY AND SYSTEM REQUIREMENTS

LEVEL R **PERFORMANCE OBJECTIVE:** Given instruction, a pump, motor, tools, pump specification sheet and shop manuals, determine pump capacity and system requirements.

ENABLING OBJECTIVES:

1. **Identify two categories of pumps.**
2. **Define 'hydrodynamic pump' and give an example.**
3. **Describe hydrostatic or positive displacement.**
4. **Explain the operation of rotary, gear, and piston pumps.**
5. **Explain how to find manufacturers maximum working pressure.**
6. **Calculate delivery in G.P.M. using a flow meter.**
7. **Determine line sizes and hose pressure requirements using charts and calculations.**
8. **Demonstrate use of a pressure gauge.**
9. **Describe how pumps are rated.**
10. **Calculate pump displacement when given the formula.**
11. **Calculate pump flow rate when given the formula.**

16.02 TASK: IDENTIFY PACKING AND SEAL REQUIREMENTS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, and various types of packing and seals, identify packing and seal requirements.

ENABLING OBJECTIVES:

1. **Identify types of seals and packing.**
2. **Define terms associated with packing and seals.**
3. **Explain the use of static seals.**
4. **Explain the use and applications of dynamic seals.**
5. **List five factors to consider when selecting seals or packing.**
6. **Distinguish between seals and packing.**

16.03 TASK: EXPLAIN THE OPERATING PRINCIPLES OF CENTRIFUGAL, PROPELLER AND TURBINE ROTARY, RECIPROCATING AND METERING PUMPS.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, various pumps and/or training aids, explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating and metering pumps.

ENABLING OBJECTIVES:

1. Discuss hydrodynamic and hydrostatic pumps.
2. Identify each type of pump.
3. Discuss positive displacement pumps.
4. Discuss differences between variable and non-variable pumps.
5. Differentiate between impeller and propeller type pumps.
6. Explain the difference between rotary pumps and reciprocating pumps.
7. Discuss balanced and unbalanced pump designs.
8. Explain the operation of a two stage pump.

16.04 TASK: DISSEMBLE AND REASSEMBLE A PUMP

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a pump, necessary tools, and shop manuals, disassemble and reassemble a pump.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with pumps.
2. Mark a pump for correct alignment on reassembly.
3. Discuss seals and their proper installation.
4. Discuss factors that cause pumps to leak.
5. Discuss pump bearings.
6. Discuss how to examine a pump for wear.
7. List four common causes of pump failure.
8. Disassemble and reassemble a pump.

16.05 TASK: PERFORM PUMP MAINTENANCE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a pump in a system, maintenance manuals, and necessary tools and equipment, perform pump maintenance according to manufacturer's specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions when performing pump maintenance.
2. Discuss the importance of a good maintenance program.
3. Discuss possible effects of poor maintenance.
4. Describe key maintenance problems.
5. Discuss filters, and containments.
6. Discuss the effects of containments on oil and additives.
7. Perform pump maintenance.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 17

**MAINTAIN PIPING SYSTEMS AND
ACCESSORIES**

MODULE 17 - MAINTAIN PIPING SYSTEMS AND ACCESSORIES

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 17 - MAINTAIN PIPING SYSTEMS AND ACCESSORIES

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 17.01 | Identify the components of a piping system. |
| E | 17.02 | Explain the maintenance features of both metallic and non-metallic piping systems. |
| E | 17.03 | Explain valve operation and maintenance. |
| E | 17.04 | Explain the use and maintenance of strainers, filters, and traps in piping systems. |
| E | 17.05 | Bend and join copper tubing. |
| E | 17.06 | Bend and join steel tubing |
| E | 17.07 | Join common fittings. |
| E | 17.08 | Join metallic pipe. |
| E | 17.09 | Join plastic pipe. |

MAINTAIN PIPING SYSTEMS AND ACCESSORIES

17.01 TASK: IDENTIFY THE COMPONENTS OF A PIPING SYSTEM

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction and necessary reference materials, identify the components of a piping system.

ENABLING OBJECTIVES:

1. **Discuss the applications of piping systems.**
2. **Identify different types of pipe.**
3. **Identify valves in piping systems.**
4. **Discuss the use of pipe.**
5. **Identify types of fittings.**
6. **Identify types of hangers.**
7. **List types of piping accessories.**

17.02 TASK: EXPLAIN THE MAINTENANCE FEATURES OF BOTH METALLIC AND NONMETALLIC PIPING SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, components of piping systems, and necessary references, explain the maintenance features of both metallic and nonmetallic piping systems.

ENABLING OBJECTIVES:

1. **Discuss the maintenance of metallic pipe.**
2. **Discuss the maintenance of nonmetallic pipe.**
3. **Explain the chemical ratings of metallic and nonmetallic pipe.**
4. **Explain the pressure rating of metallic and nonmetallic pipe.**

17.03 TASK: EXPLAIN VALVE OPERATION AND MAINTENANCE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, valves, and necessary reference materials, explain valve operation and maintenance.

ENABLING OBJECTIVES:

1. **Identify types of valves.**
2. **Identify components of valves.**
3. **Explain operation of different types of valves.**
4. **Explain maintenance of different types of valves.**

17.04 TASK: EXPLAIN THE USE AND MAINTENANCE OF STRAINERS, FILTERS AND TRAPS IN PIPING SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, strainers, filters, and traps, and necessary reference materials, explain the use and maintenance of strainers, filters, and traps in piping systems.

ENABLING OBJECTIVES:

1. **Identify strainers, filters, and traps.**
2. **List the uses of strainers.**
3. **List the uses of filters.**
4. **List the uses of traps.**
5. **Explain the maintenance of filters, traps, and strainers in piping systems.**

17.05 TASK: BEND AND JOIN COPPER TUBING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, copper tubing, tools and materials, bend and join copper tubing.

1. **Explain safety precautions when bending and joining copper tubing.**
2. **Identify bending tools.**
3. **List types of copper tubing.**
4. **List types of copper tubing connections.**
5. **Cut copper tubing.**
6. **Bend copper tubing.**
7. **Prepare copper tubing for joining.**
8. **Join copper tubing by soldering joints.**

17.06 TASK: BEND AND JOIN STEEL TUBING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, steel tubing, tools, and materials, bend and join steel tubing.

ENABLING OBJECTIVES:

1. **Explain safety precautions when bending and joining steel tubing.**
2. **Cut steel tubing.**
3. **Identify connections for steel tubing.**
4. **Bend steel tubing.**
5. **Prepare and join steel tubing.**

17.07 TASK: JOIN COMMON FITTINGS

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, common fittings, tools, and materials, join common fittings.

ENABLING OBJECTIVES:

1. Explain safety precautions when joining common fittings.
2. Identify common fittings.
3. Prepare and join common fittings.

17.08 TASK: JOIN METALLIC PIPE

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, metallic pipe, pipe fitting tools, and materials, join metallic pipe.

ENABLING OBJECTIVES:

1. Explain safety precautions when joining metallic pipe.
2. Prepare metallic pipe for joining.
3. Cut metallic pipe.
4. Tread metallic pipe.
5. Select proper sealing materials.
6. Join metallic pipe.

17.09 TASK: JOIN PLASTIC PIPE

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, plastic pipe, tools, and sealant material, join plastic pipe.

ENABLING OBJECTIVES:

1. Explain safety precautions when joining plastic pipe.
2. Cut plastic pipe.
3. Prepare plastic pipe for joining.
4. Join plastic pipe.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 18

MAINTAIN AND REPAIR HYDRAULIC SYSTEM

COMPONENTS

MODULE 18 - MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 18 - MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 18.01 | Explain Pascal's Law. |
| E | 18.02 | Explain Bernoulli's Principle. |
| E | 18.03 | Explain the relationship of heat and pressure to power and transmission. |
| E | 18.04 | Describe the physical and chemical properties of a fluid. |
| E | 18.05 | Install and maintain a contaminant removal system. |
| E | 18.06 | Explain the operation and use of heat exchangers. |
| E | 18.07 | Determine reservoir requirements. |
| E | 18.08 | Select pumps for specific applications. |
| E | 18.09 | Compute hose requirements. |
| E | 18.10 | Install hydraulic lines. |
| R | 18.11 | Select and install control valves and servo-type valves. |

MAINTAIN AND REPAIR HYDRAULIC SYSTEM COMPONENTS

18.01 TASK: EXPLAIN PASCAL'S LAW

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references and training aids, explain Pascal's Law.

ENABLING OBJECTIVES:

1. Match terms from fundamentals of hydraulics with their definitions.
2. Calculate pressure when given force and area.
3. Explain the operating principles of a jack.
4. Explain Pascal's Law, using a basic hydraulic circuit.

18.02 TASK: EXPLAIN BERNOULLI'S PRINCIPLE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, equipment, and training aids, explain Bernoulli's Principle.

ENABLING OBJECTIVES:

1. Describe how power is transferred in a hydraulic system.
2. Explain what gives an airplane its lift.
3. Discuss the flow rate of liquid in a passageway of variable sizes.
4. Discuss the pressure of a liquid in a passageway of variable size.
5. Discuss kinetic energy and contrast it with hydrostatic energy.
6. Explain "Venturi Principle".
7. Describe Bernoulli's Effect.

18.03 TASK: EXPLAIN THE RELATIONSHIP OF HEAT AND PRESSURE TO POWER AND TRANSMISSION

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, training aids, and other materials, explain the relationship of heat and pressure to power and transmission in a hydraulic system.

ENABLING OBJECTIVES:

1. Describe the effect of temperature on the viscosity of hydraulic fluids.
2. List conditions that can cause foaming.
3. Discuss the effect of foaming on power and transmission.
4. Explain the effect of heat on the viscosity of oil.
5. Explain the effect of heat on oils film strength.

18.04 TASK: DESCRIBE THE PHYSICAL AND CHEMICAL PROPERTIES OF A FLUID.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, fluids, and reference materials, describe the physical and chemical properties of a fluid.

ENABLING OBJECTIVES:

1. Describe the physical and chemical properties of a fluid.
2. Define matter.
3. Define molecule.
4. Explain physical and chemical effects of heat and cold on fluids.
5. Define viscosity.

18.05 TASK: DESCRIBE THE PHYSICAL AND CHEMICAL PROPERTIES OF HYDRAULIC FLUID.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, various hydraulic fluids, and references, describe the physical and chemical properties of hydraulic fluid.

ENABLING OBJECTIVES:

1. Discuss terms associated with hydraulic fluids.
2. Define the SAE rating of hydraulic fluids.
3. Discuss nature and use of additives.
4. Discuss the primary functions of hydraulic fluids.
5. Discuss "pour point" and "pump ability" of a fluid.
6. Explain the effects of containments in hydraulic fluid.
7. Describe the physical and chemical properties of hydraulic fluids.
8. Describe the oil refining process.
9. Identify types of petroleum and other hydraulic fluids.
10. Explain the API service rating.

18.06 TASK: EXPLAIN THE OPERATION AND USE OF HEAT EXCHANGERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a hydraulic system, and references, explain the operation and use of heat exchangers.

ENABLING OBJECTIVES:

1. Discuss the effect of temperature on the viscosity of hydraulic oils.
2. Explain the functions of heat exchangers.
3. Identify two types of heat exchangers.
4. Discuss servicing each type of heat exchanger.
5. Describe the capacity of heat exchangers.
6. List common failures of heaters.
7. List common failures of coolers.

18.07 TASK: DETERMINE RESERVOIR REQUIREMENTS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a hydraulic system, use specifications, and references, determine reservoir requirements.

ENABLING OBJECTIVES:

1. **Define reservoir.**
2. **Name two types of reservoirs.**
3. **Discuss reasons for using a pressurized reservoir.**
4. **List functions of a reservoir.**
5. **Describe the purposes of a reservoir.**
6. **Describe the "rule of thumb" for selecting the size of a reservoir.**

18.08 TASK: CLASSIFY AND SELECT PUMPS FOR SPECIFIC APPLICATIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, pumps, a specific job description, and references, classify and select a pump for the specific application.

ENABLING OBJECTIVES:

1. **Define terms related to pumps.**
2. **Distinguish between positive and non-positive displacement pumps.**
3. **Identify types of positive displacement pumps.**
4. **Calculate pump input and output power when given formula.**
5. **Calculate pump flow rate when given formula.**
6. **Calculate pump displacement when given formula.**
7. **Calculate pump volumetric efficiency.**
8. **Discuss the operation of a gear pump.**
9. **Discuss the operation of a vane pump.**
10. **Distinguish between an axial and a radial piston pump.**
11. **Identify types of axial piston pumps.**
12. **Describe the operation of a radial piston pump.**
13. **Discuss the construction and operation of axial piston pumps.**
14. **Describe the operation of a variable displacement axial piston pump.**
15. **Identify the parts of a servo-controlled variable displacement pump.**
16. **Identify the functional components of a pressure compensated axial piston pump.**
17. **List four causes of hydraulic pump cavitation.**
18. **List common causes of hydraulic pump failure.**
19. **Select a pump for a specific application.**

18.09 TASK: COMPUTE HOSE REQUIREMENTS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a pump, specifications, references, and a specified job requirement, compute hose requirements.

ENABLING OBJECTIVES:

1. Calculate the flow rate when given the formula.
2. Calculate pressure of the system.
3. Determine operating temperature of system.
4. Discuss factors that effect hose pressure rating.
5. List four types of hoses.
6. Discuss hose size and pressure requirements.
7. Discuss the effect of hydraulic fluids on various types of hose material.
8. Explain causes of hose failures.

18.10 TASK: INSTALL HYDRAULIC LINES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, hydraulic lines, a hydraulic unit, necessary tools, and references, install hydraulic lines.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing hydraulic lines.
2. Define terms related to lines, fittings, and couplers.
3. Discuss the characteristics of various hydraulic hoses.
4. Identify types of fittings commonly used with hoses and tubing.
5. Identify types of hose-ends used in hydraulic systems.
6. Discuss factors to consider in routing hoses.
7. List conditions to avoid when routing hoses.
8. Discuss sealants and their correct use in a hydraulic system.

18.11 TASK: SELECT AND INSTALL CONTROL VALVES AND SERVO-TYPE VALVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a selection of valves, hydraulic equipment, necessary tools, and references, select and install control valves and servo-type valves.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing hydraulic valves.
2. Define terms related to valves.
3. Identify three categories of valves.
4. Identify three types of pressure control valves.
5. Identify pressure relief valves types when described in operation.
6. Discuss the operation of a pressure reducing valve.
7. List three types of flow control valves.
8. Discuss the operation of a needle valve as a flow control device.
9. Describe the operation of a pressure compensated flow control valve.
10. Describe the operation of a proportional flow divider.
11. Identify types of directional control valves.
12. Distinguish between the operation of a check valve and a spool direction control valve.
13. Discuss the flow paths in a directional control valve controlling a cylinder.
14. Distinguish between open center and closed center systems.
15. Select types of directional control valves for actuators.
16. Select and install a hydraulic control valve.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 19

TROUBLESHOOT HYDRAULIC SYSTEMS

MODULE 19 - TROUBLESHOOT HYDRAULIC SYSTEMS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 19 - TROUBLESHOOT HYDRAULIC SYSTEMS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 19.01 | Explain a hydraulic schematic. |
| E | 19.02 | Connect electrically controlled valves. |
| E | 19.03 | Explain hydraulic system troubleshooting techniques. |
| E | 19.04 | Repair and replace hydraulic valves. |
| E | 19.05 | Repair and replace hydraulic cylinders. |

TROUBLESHOOTING HYDRAULIC SYSTEMS

19.01 TASK: EXPLAIN A HYDRAULIC SCHEMATIC

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, hydraulic schematics, and references, explain a hydraulic schematic.

ENABLING OBJECTIVE:

1. Define terms and symbols related to hydraulic circuits and diagrams.
2. Identify the components of a basic hydraulic circuit.
3. Distinguish between types of hydraulic circuits.
4. Discuss advantages and disadvantages of open-center and closed-center systems.
5. Discuss fluid flow in an open-center circuit.
6. Discuss fluid flow in multiple actuator open-center systems.
7. Describe valves in the neutral and shifted positions in the fluid flow in a closed-center system.
8. Identify the symbols used in a hydraulic schematic.
9. Identify the symbols for various directional control valves.
10. Explain a schematic of an open-center and a closed-center system.
11. Explain an open-center hydraulic circuit.

19.02 TASK: CONNECT ELECTRICALLY CONTROLLED VALVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a hydraulic system with electrically controlled valves, tools, manuals, and wire, connect electrically controlled valves.

ENABLING OBJECTIVES:

1. Explain safety precautions when working with electrically controlled valves.
2. Identify symbols used in electrical schematics.
3. Discuss conduit, cables, and wires used with control valves.
4. Discuss the effects of contaminants on various types of wire insulation.
5. Discuss wiring color codes.
6. Connect an electrically controlled valve.

19.03 TASK: EXPLAIN HYDRAULIC SYSTEM TROUBLESHOOTING TECHNIQUES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, hydraulic equipment, and references, explain hydraulic system troubleshooting techniques.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting hydraulic systems.
2. Define terms associated with hydraulic diagnosis and testing.
3. List in order the steps in troubleshooting.
4. Identify the types of hydraulic system testers.
5. List remedies for inoperative systems.
6. List remedies for systems that operate erratically.
7. List remedies for systems that operate slowly.
8. Discuss two remedies for systems that operate too fast.
9. List causes of foaming fluid.

10. List remedies for foaming fluid.
11. List remedies for excessive pump noise.
12. List two remedies for leaking pumps.
13. List remedies for load drop when the control valve is in the neutral position.
14. List problems which can cause the control valve to malfunction.
15. Identify problems which can cause a control valve to leak.
16. List problems which can cause a cylinder to leak.
17. List three problems which can cause a cylinder to actually lower when a control valve is moved to slowly raise a cylinder.
18. Identify problems and remedies for brake malfunctions.
19. Identify problems and remedies for power steering malfunctions.

19.04 TASK: REPAIR AND REPLACE HYDRAULIC VALVES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a hydraulic system with hydraulic valves, manuals, tools, and necessary materials, repair and replace hydraulic valves.

ENABLING OBJECTIVES:

1. Explain safety precautions when working on hydraulic valves.
2. Discuss importance of cleanliness when working on hydraulic valves.
3. List common causes of valve failure.
4. Mark parts for correct reassembly.
5. Disassemble, inspect, and reassemble a pressure control valve.
6. Disassemble, inspect and reassemble a directional control valve.
7. Disassemble, inspect and reassemble a flow control valve.

19.05 TASK: REPAIR AND REPLACE HYDRAULIC CYLINDERS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, hydraulic cylinders, manuals, tools, and necessary materials, repair and replace hydraulic cylinders.

ENABLING OBJECTIVES:

1. Explain safety precautions when working on hydraulic cylinders.
2. Define terms related to hydraulic cylinders.
3. Discuss the operation of a hydraulic cylinder.
4. Distinguish between single-acting and double-acting cylinders.
5. Identify the parts of a hydraulic cylinder.
6. List common causes of failures of hydraulic cylinders.
7. Discuss symptoms of internal leakage.
8. List service precautions for installing seals.
9. Explain procedure to check for rust and pitting problems.
10. Describe a general disassembly procedure.
11. Repair and replace a hydraulic cylinder.

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

MODULE 20

**EXPLAIN RECIPROCATING AND ROTARY
AIR COMPRESSORS**

MODULE 20 - EXPLAIN RECIPROCATING AND ROTARY AIR COMPRESSORS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 20 - EXPLAIN RECIPROCATING AND ROTARY AIR COMPRESSORS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 20.01 | Explain the relationship of force, weight, mass, and density in a pneumatic system. |
| E | 20.02 | Explain the operation of reciprocating compressors. |
| E | 20.03 | Explain the operation of rotary compressors. |
| E | 20.04 | Explain primary and secondary air treatment. |

EXPLAIN RECIPROCATING AND ROTARY AIR COMPRESSORS

20.01 TASK: EXPLAIN THE RELATIONSHIP OF FORCE, WEIGHT, MASS, AND DENSITY IN A PNEUMATIC SYSTEM

LEVEL E **PERFORMANCE OBJECTIVES:** Given instructions, demonstrations, and references, explain the relationship of force, weight, mass, and density in a pneumatic system.

ENABLING OBJECTIVES:

1. Explain the principles of force transmission in a pneumatic system.
2. List two factors that affect the results of pressure calculations.
3. Explain the physical laws affecting the behavior of a confined gas.
4. Explain the difference between speed and velocity.
5. Solve mathematically simple problems for displacement, pressure, and velocity.
6. Apply the mathematical application of displacement, pressure, and velocity to a system and give examples of the effect each has on a total system.

20.02 TASK: EXPLAIN THE OPERATION OF RECIPROCATING COMPRESSORS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, demonstrations, references and necessary materials, explain the operation of reciprocating compressors.

ENABLING OBJECTIVES:

1. Identify parts of the intake system, the exhaust system, the cooling arrangement, and storage tank and the electrical and pressure controls of reciprocating compressors, using parts manuals.
2. Explain the operation of a reciprocating compressor.
3. Compare a multi-stage compressor to a single stage compressor and identify several applications suited to each.

20.03 TASK: EXPLAIN THE OPERATION OF ROTARY COMPRESSORS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, demonstrations, references and necessary materials, explain the operation of rotary compressors.

ENABLING OBJECTIVES:

1. Explain the differences between a centrifugal and positive-displacement rotary compressor.
2. List at least four types of rotary compressors with a brief explanation of how they work and give an application or advantage for each.

20.04 TASK: EXPLAIN PRIMARY AND SECONDARY AIR TREATMENT

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, demonstrations, references and necessary materials, explain primary and secondary air treatment.

ENABLING OBJECTIVES:

- 1. Describe appropriate techniques for cleaning compressor filters.**
- 2. Define relative humidity and ambient temperature and relate how they affect the primary air supply of a compressor.**
- 3. Describe after cooler operation and the need for an after cooler.**
- 4. Explain the functions of separators, oil scrubbers, and air dryers.**
- 5. Describe the two main methods of contaminant separation.**
- 6. Explain how filters are classified and why they are used.**
- 7. List contaminant particle sizes and particle contamination categories as they occur in filters.**
- 8. Describe location for lubrication equipment installation and the purpose of those systems.**
- 9. Explain primary and secondary air treatment.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

**MODULE 21
TROUBLESHOOT PNEUMATIC SYSTEMS**

MODULE 21 - TROUBLESHOOT PNEUMATIC SYSTEMS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 21 - TROUBLESHOOT PNEUMATIC SYSTEMS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 21.01 | Identify schematic symbols and diagrams used in pneumatic systems. |
| E | 21.02 | Diagram an air supply system. |
| E | 21.03 | Install pneumatic system components. |
| E | 21.04 | Explain pneumatic system maintenance techniques. |
| E | 21.05 | Explain pneumatic system troubleshooting procedures. |
| E | 21.06 | Troubleshoot air compressors. |
| E | 21.07 | Troubleshoot pneumatic control valves. |
| E | 21.08 | Troubleshoot, repair, and install control valves. |
| E | 21.09 | Troubleshoot air motors. |
| E | 21.10 | Troubleshoot air dryers. |

TROUBLESHOOT PNEUMATIC SYSTEMS

21.01 TASK: IDENTIFY THE SCHEMATIC SYMBOLS AND DIAGRAMS USED IN PNEUMATIC SYSTEMS.

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, manuals, and necessary materials, identify the schematic symbols and diagrams used in pneumatic systems.

ENABLING OBJECTIVES:

1. **Discuss the symbols used in pneumatic schematics.**
2. **Identify a schematic among other kinds of technical drawings and diagrams.**
3. **Explain how flow is indicated on a schematic.**
4. **Identify various types of lines on schematics.**
5. **Identify the symbols for valves, pumps, actuators, and accessories.**

21.02 TASK: DIAGRAM AN AIR SUPPLY SYSTEM

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, manuals, and necessary materials, diagram an air supply system.

ENABLING OBJECTIVES:

1. **Diagram the air supply in a shop using standard symbols.**
2. **Diagram various pneumatic attachments, i.e. air wrench motor or regulators, connected to a shop air supply system using standard symbols.**

21.03 TASK: INSTALL PNEUMATIC SYSTEM COMPONENTS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, pneumatic systems, pneumatic parts, manuals, tools, and necessary materials, install pneumatic system components.

ENABLING OBJECTIVES:

1. **Explain safety precautions when installing pneumatic components.**
2. **Describe installation of a compressor.**
3. **Describe installation of after-coolers, receivers, and dryers.**
4. **Explain procedures for installing pipes, tubes, hoses, and hangers in pneumatic systems.**
5. **Explain design criteria for pressure and flow requirements.**
6. **Describe installation of control valves, solenoid coils, and cylinders.**
7. **Install pneumatic system components.**

21.04 TASK: EXPLAIN PNEUMATIC SYSTEM MAINTENANCE TECHNIQUES

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, necessary materials, demonstrations, and manuals, explain pneumatic system maintenance techniques.

ENABLING OBJECTIVES:

1. Discuss safety procedures for pneumatic system maintenance.
2. Explain the concept of planned maintenance.
3. Describe a procedure for measuring pressure, vacuum, and system condition.
4. List primary and secondary treatment components and give examples of maintenance procedures for each.
5. List preventative maintenance procedures for reciprocating compressors.
6. List preventative maintenance procedures for rotary compressors.
7. Describe the maintenance of industrial control circuit components.
8. Explain the proper maintenance of pneumatic tools.
9. Discuss maintenance logs and explain the information recorded in them.

21.05 TASK: EXPLAIN PNEUMATIC SYSTEM TROUBLESHOOTING PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, necessary materials, demonstrations, and manuals, explain pneumatic system troubleshooting procedures.

ENABLING OBJECTIVES:

1. Discuss safety precautions for troubleshooting pneumatic systems.
2. List, in proper sequence, the steps to be taken in troubleshooting a pneumatic system.
3. Identify several failure analysis resources for various components.
4. List the components of an effective delivered-air system and explain how they work together.
5. Describe types of schematic symbols used in pneumatic diagrams and show how they are used in troubleshooting.
6. Describe the operation of safety circuits and sequencing circuits.

21.06 TASK: TROUBLESHOOT AIR COMPRESSORS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, air compressors, tools, demonstrations, and manuals, troubleshoot air compressors.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting air compressors.
2. Describe methods of cooling and lubricating reciprocating compressors.
3. Explain the proper maintenance of compressor valves.
4. Identify problems associated with the control system of a compressor.
5. Describe the basic maintenance requirements of rotary fan, rotary screw, and centrifugal compressors.
6. Troubleshoot a faulty air compressor and determine repairs needed.

21.07 TASK: TROUBLESHOOT PNEUMATIC CONTROL VALVES

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, pneumatic control valves, tools, demonstrations, and manuals, troubleshoot pneumatic control valves.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting pneumatic control valves.
2. Outline procedures to isolate a control malfunction in a pneumatic circuit including remote operation of a valve.
3. Explain procedures to troubleshoot a non-starting or non-operating circuit, improper sequencing of a circuit, and other mechanical problems related to this equipment.
4. Explain procedures for checking valve shifting, control timing, and lubrication.
5. Troubleshoot a faulty pneumatic control valve and determine repairs needed.

21.08 TASK: TROUBLESHOOT AIR CYLINDERS

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, air cylinders, tools, demonstrations, and manuals, troubleshoot air cylinders.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting air cylinders.
2. Explain operation of a linear actuator in a typical pneumatic circuit.
3. Identify different types of air cylinders.
4. Describe construction of a typical cylinder.
5. Describe procedures for troubleshooting cylinders, including checking for misalignment, worn packing, and adequate air pressure.
6. Explain installation techniques for cylinders and accessories.
7. Troubleshoot a faulty air cylinder and determine repairs needed.

21.09 TASK: TROUBLESHOOT AIR MOTORS

LEVEL E PERFORMANCE OBJECTIVES: Given instructions, air motors, tools, demonstrations, and manuals, troubleshoot air motors.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting air motors.
2. Explain procedures to check clean air supply when troubleshooting an in-operative air motor.
3. Explain procedures for maintaining air motor hoses, clamps, and couplings.
4. Describe the operation and maintenance of vane, radial-piston, and axial-piston air motors.
5. Troubleshoot a faulty air motor and determine repairs needed.

21.10 TASK: TROUBLESHOOT AIR DRYERS

LEVEL E PERFORMANCE OBJECTIVES: Given instruction, air dryers, tools, demonstrations, and manuals, troubleshoot air dryers.

ENABLING OBJECTIVES:

1. Explain safety precautions when troubleshooting air dryers.
2. Explain the function of an air dryer.
3. Identify the functional parts of an air dryer.
4. Describe procedures for troubleshooting an air dryer.
5. Troubleshoot a faulty air dryer and determine repairs needed.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 22

**EXPLAIN THE OPERATION OF INDUSTRIAL
POLLUTION CONTROL SYSTEMS**

MODULE 22 - EXPLAIN POLLUTION CONTROL SYSTEMS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 22 - EXPLAIN THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYSTEMS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 22.01 | Explain the operation of air pollution control systems. |
| E | 22.02 | Explain the operation of water pollution control systems. |
| E | 22.03 | Explain the operation of solid waste pollution control systems. |
| E | 22.04 | Explain the operation of noise pollution control systems. |
| E | 22.05 | Explain the basic philosophy of "right to know" legislation. |

EXPLAIN THE OPERATION OF INDUSTRIAL POLLUTION CONTROL SYSTEMS

22.01 TASK: EXPLAIN THE OPERATION OF AIR POLLUTION CONTROL SYSTEMS.

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, demonstrations, and manuals, explain the operation of air pollution control systems.

ENABLING OBJECTIVES:

1. **Discuss the purpose(s) of air pollution control equipment.**
2. **Describe types of air pollution control equipment.**
3. **Explain the operation of air pollution equipment.**

22.02 TASK: EXPLAIN THE OPERATION OF WATER POLLUTION CONTROL SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, demonstrations, and manuals, explain the operation of water pollution control systems.

ENABLING OBJECTIVES:

1. **Discuss the purpose(s) of water pollution control systems.**
2. **Describe types of water pollution control equipment.**
3. **Explain the operation of water pollution control systems.**

22.03 TASK: EXPLAIN THE OPERATION OF SOLID WASTE POLLUTION CONTROL SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, demonstrations, and manuals, explain the operation of solid waste pollution control systems.

ENABLING OBJECTIVES:

1. **Define solid waste.**
2. **Discuss the purpose(s) of solid waste pollution control systems.**
3. **Describe types of solid waste pollution control systems.**
4. **Explain the operation of solid waste pollution control systems.**

22.04 TASK: EXPLAIN THE OPERATION OF NOISE POLLUTION CONTROL SYSTEMS

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, demonstrations, and manuals, explain the operation of noise pollution control systems.

ENABLING OBJECTIVES:

1. **Discuss sources of noise pollution.**
2. **Define decibel.**
3. **Describe types of noise pollution control.**
4. **Explain the operation of noise pollution control systems.**

22.05 TASK: EXPLAIN THE BASIC PHILOSOPHY OF "RIGHT TO KNOW" LEGISLATION

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, references, and manuals, explain the basic philosophy of "Right to Know" legislation.

ENABLING OBJECTIVES:

- 1. Identify Material Safety Data Sheets (MSDS).**
- 2. Identify the categories common to all MSDS forms.**
- 3. Explain terms found on MSDS sheets (e.g. Flash point and vapor density).**
- 4. Explain the importance of reading and understanding product labels.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

**MODULE 23
PERFORM RIGGING FUNCTIONS**

MODULE 23 - PERFORM RIGGING FUNCTIONS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 23 - PERFORM RIGGING FUNCTIONS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 23.01 | Estimate the weight of a load. |
| E | 23.02 | Find the center of gravity. |
| E | 23.03 | Identify the rigging and slings used in maintenance work. |
| E | 23.04 | Explain safety inspection procedures for rigging, ropes, and slings. |
| E | 23.05 | Identify rope fiber types. |
| E | 23.06 | Tie rigging knots, bends, and hitches. |
| E | 23.07 | Identify types of wire rope. |
| E | 23.08 | Cut and seize wire rope. |
| E | 23.09 | Install wire rope eyes, sockets, and hooks. |
| E | 23.10 | Identify cranes and hoists. |
| E | 23.11 | Erect a scaffold and install planking. |
| E | 23.12 | Raise a ladder. |
| E | 23.13 | Rig life belts and life nets. |

PERFORM RIGGING FUNCTIONS

23.01 TASK: ESTIMATE THE WEIGHT OF A LOAD

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a large object to be lifted, formulas, descriptive materials and tables, determine the object's volume and estimate its weight.

ENABLING OBJECTIVES:

1. Explain the safety importance of proper weight estimation.
2. Identify possible sources of an object's weight.
3. Describe formulas to find the volume of common plane figures, using an Engineer's Handbook.
4. Estimate the weight of a unit volume of: (a) steel, (b) aluminum, (c) cedar (wood), (d) limestone.
5. Describe how volume is estimated when the object has a complex shape.
6. Estimate the weight of a load.

23.02 TASK: FIND THE CENTER OF GRAVITY

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, an object to be lifted, descriptive materials and instructions, cardboard, string, and weights, find the center of gravity of the object.

ENABLING OBJECTIVES:

1. Explain safety reasons for finding center of gravity of an object.
2. Identify the planes (directions) which locate the center of gravity.
3. Describe the simple way to locate the center of gravity of a plane or irregular shape.
4. Describe the use of scale in finding the center of gravity.
5. Find the center of gravity of an object being lifted.

23.03 TASK: IDENTIFY THE RIGGING AND SLINGS USED IN MAINTENANCE WORK

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, an assortment of rigging and slings used in maintenance work, and necessary references, identify the rigging and slings used in maintenance work.

ENABLING OBJECTIVES:

1. Explain safety reasons for using rigging and slings.
2. Discuss application of simple machines.
3. Describe the use of block and tackle.
4. Identify the parts of a block.
5. Identify a sling.
6. Describe six common sling arrangements.
7. Discuss the proper use of hooks and shackles.

23.04 TASK: EXPLAIN SAFETY INSPECTION PROCEDURES FOR RIGGING, ROPES, AND SLINGS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, a variety of rigging, ropes, and sling arrangements, and necessary references, explain the safety inspection procedures for rigging, ropes, and slings.

ENABLING OBJECTIVES:

1. Describe mousing.
2. Describe proper rigging for rotating a load.
3. Determine working loads for slings.
4. Describe a sling safety inspection.
5. Explain the dangers of frayed ropes or broken wires.
6. Describe the defects which might occur in hooks, shackles, and rings.
7. Discuss the reliability of chain slings.
8. Explain safety inspection procedures.

23.05 TASK: IDENTIFY ROPE FIBER TYPES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a variety of ropes, manuals, and necessary references, identify rope fiber types.

ENABLING OBJECTIVES:

1. Describe the safety factor in selecting ropes.
2. Identify common natural vegetable fiber ropes.
3. Identify common synthetic fiber ropes.
4. Describe the characteristics of manila, sisal, hemp, and cotton ropes.
5. Describe the properties of common synthetic rope fibers.
6. Discuss fiber rope forms.
7. Discuss fiber rope sizing.
8. Identify rope fiber types.

23.06 TASK: TIE RIGGING KNOTS, BENDS, AND HITCHES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, fiber rope, handling materials, and necessary references, tie rigging knots, bends, and hitches.

ENABLING OBJECTIVES:

1. Explain the safety importance of proper knots, bends and hitches.
2. Define: (a) knot, (b) bend, (c) hitch.
3. Describe the effect of sharp bends in a knot.
4. Describe the use of a: (a) crown knot, (b) sheepshank, (c) bowline, (d) double bowline, (e) bowline on a bight, (f) sheep bend, (g) half hitch, (h) clove hitch, (i) rolling hitch, (j) timber hitch, (k) back hitch, (l) cat's paw hitch.
5. Tie knots, bends, and hitches.

23.07 TASK: IDENTIFY TYPES OF WIRE ROPE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, wire ropes and necessary references, identify types of wire rope.

ENABLING OBJECTIVES:

1. Explain the breaking strength safety factor for wire rope loads.
2. Define wire rope.
3. Identify wire rope materials.
4. Define preformed and nonpreformed wire rope.
5. Discuss regular lay and Lang lay wire rope.
6. Discuss the purposes of core material.
7. Identify types of wire rope.

23.08 TASK: CUT AND SEIZE WIRE ROPE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a wire rope, seizing materials, necessary tools, and appropriate references, cut and seize wire rope.

ENABLING OBJECTIVES:

1. Explain safety precautions when applying seizing and cutting wire rope.
2. Determine seizing specifications using a rigging handbook.
3. Describe the technique for applying seizing.
4. Demonstrate the proper technique for cutting wire rope.
5. Cut and seize wire rope.

23.09 TASK: INSTALL WIRE ROPE EYES, SOCKETS, AND HOOKS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, an assortment of wire ropes and rigging, necessary eyes, sockets, and hooks, and appropriate references, install wire rope eyes, sockets, and hooks.

ENABLING OBJECTIVES:

1. Explain safety precautions when installing wire rope eyes, sockets, and hooks.
2. Identify a wire rope eye.
3. Identify a wire rope socket.
4. Identify a wire rope hook.
5. Describe the clips used for wire rope eyes.
6. Discuss the use of left and right lay clips.
7. Describe the installation of a wedge socket.
8. Describe the installation of a speltered socket.
9. Describe the installation of a hook.
10. Install wire rope eyes, sockets, and hooks.

23.10 TASK: IDENTIFY CRANES AND HOISTS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a variety of cranes and hoists in an operational setting, diagrams, and necessary references, identify cranes and hoists.

ENABLING OBJECTIVES:

1. Describe traveling cranes.
2. Discuss variations of gantry cranes.
3. Identify mounted (locomotive and truck) cranes.
4. Identify a hydraulic boom.
5. Describe several types of chain hoists.
6. Describe the hooks and fittings used on chain hoists.
7. Discuss the typical uses of the following lifting equipment: (a) fork lift, (b) pallet lift, (c) three wheel warehouse truck, (d) capstan.
8. Identify cranes and hoists.

23.11 TASK: ERECT A SCAFFOLD AND INSTALL PLANKING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, scaffolding equipment, planking, necessary tools, and appropriate references, erect a scaffold and install planking.

ENABLING OBJECTIVES:

1. Explain safety precautions when erecting scaffolding and planking.
2. Define terms associated with scaffolding requirements.
3. Describe scaffold planking.
4. List common types of scaffolds.
5. Describe guy lines and anchorages.
6. Calculate the safe load for timber planking on a scaffold.
7. Erect a scaffold and install planking.

23.12 TASK: RAISE A LADDER

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a portable single or extension ladder, a work site, and appropriate references, raise the ladder.

ENABLING OBJECTIVES:

1. Explain safety precautions when raising ladders.
2. List the basic type of ladders.
3. Describe the best way to raise a long single ladder or short extension ladder alone.
4. Describe the procedure for raising very long ladders.
5. Raise a ladder.

23.14 TASK: RIG LIFE BELTS AND LIFE NETS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, lifebelt and life net equipment, necessary tools, and appropriate references (including federal requirements), rig

lifebelts and life nets.

ENABLING OBJECTIVES:

- 1. Explain safety precautions and federal requirements when rigging lifebelts and life nets.**
- 2. Identify a lifebelt.**
- 3. Identify a life net.**
- 4. Discuss conditions which require the use of lifebelts or life nets.**
- 5. Demonstrate the proper fitting of a lifebelt.**
- 6. Demonstrate inspection procedure for lifebelts and life nets.**
- 7. Rig life belts and life nets.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

MODULE 24

**EXPLAIN EQUIPMENT INSTALLATION
PROCEDURES**

MODULE 24 - EXPLAIN EQUIPMENT INSTALLATION PROCEDURES

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TASK LISTING

MODULE 24 - EXPLAIN EQUIPMENT INSTALLATION PROCEDURES

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 24.01 | Explain relocation procedures for new equipment in an existing facility. |
| E | 24.02 | Explain the use of anchors and isolators. |
| E | 23.03 | Explain procedures for moving and installing new equipment. |
| E | 24.04 | Explain leveling and aligning procedures. |
| E | 24.05 | Explain test run guidelines. |
| E | 24.06 | Explain safety precautions for equipment installation procedures. |
| E | 24.07 | Explain grouting procedures. |

EXPLAIN EQUIPMENT INSTALLATION PROCEDURES

24.01 TASK: EXPLAIN RELOCATION PROCEDURES FOR NEW EQUIPMENT IN AN EXISTING FACILITY

LEVEL E **PERFORMANCE OBJECTIVES:** Given instruction, materials and appropriate references, explain relocation procedures for new equipment in an existing facility.

ENABLING OBJECTIVES:

1. **Explain planning and safety procedures.**
2. **Explain unloading/uncrating procedures.**
3. **Explain requirements for power to operate new equipment.**
4. **Explain relocation procedures for new equipment.**

24.02 TASK: EXPLAIN THE USE OF ANCHORS AND ISOLATORS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, materials, and appropriate references, explain the use of anchors and isolators.

ENABLING OBJECTIVES:

1. **Identify types of equipment anchors.**
2. **Explain ways equipment is vibration and sound isolated.**
3. **Explain the use of anchors and isolators.**

24.03 TASK: EXPLAIN PROCEDURES FOR MOVING AND INSTALLING NEW EQUIPMENT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, materials, and appropriate references, explain procedures for moving and installing new equipment.

ENABLING OBJECTIVES:

1. **Compute requirements for safe rigging and moving of new equipment.**
2. **Determine foundation preparation requirements.**
3. **Explain procedures for lifting equipment.**
4. **Explain procedures for transporting equipment.**
5. **Explain procedures for setting new equipment.**

24.04 TASK: EXPLAIN LEVELING AND ALIGNING PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, materials, and appropriate references, explain leveling and aligning procedures.

ENABLING OBJECTIVES:

1. Explain safety concerns when leveling and aligning equipment.
2. Explain the types of leveling and aligning instruments and their accuracy.
3. Explain use of ratio and proportion in leveling.
4. Explain use of alignment tools.
5. Discuss perpendicular reference lines.
6. Explain the use of a transit.
7. Explain the procedure for leveling and aligning a piece of equipment.

24.05 TASK: EXPLAIN TEST RUN GUIDELINES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and appropriate references, explain test run guidelines.

ENABLING OBJECTIVES:

1. Explain safety precautions when doing test runs.
2. Explain the purpose of test runs.
3. Explain test run guidelines for a specific machine.

24.06 TASK: EXPLAIN SAFETY PRECAUTIONS FOR EQUIPMENT INSTALLATION PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, equipment references, and safety instructions, explain safety precautions for equipment installation procedures.

ENABLING OBJECTIVES:

1. Identify sources of safety information for equipment installation.
2. Explain personal safety precautions when rigging/moving equipment.
3. Explain safety precautions for equipment start-up.

24.07 TASK: EXPLAIN GROUTING PROCEDURES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and manuals, explain grouting procedures.

ENABLING OBJECTIVES:

1. Identify sources of information for grouting procedures.
2. Explain requirements for bed plates prior to grouting.
3. Explain different types of grout.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 25

**PERFORM MACHINE SHOP TURNING
OPERATIONS**

MODULE 25 - PERFORM MACHINE SHOP TURNING OPERATIONS

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It is the goal of this program guide to provide a level of instruction which will impart entry level employment skills. Students should be carefully counseled on the importance of attaining competency in the tasks assigned. As in virtually all occupations today industrial mechanics will require periodic up-dating and review in the future. It is important that each student understand that meeting the program standards is essential not only to obtain employment today but also to have a base upon which to retain employment in the future.

IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 25 - PERFORM MACHINE SHOP TURNING OPERATIONS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 25.01 | Identify the principal parts of an engine lathe. |
| E | 25.02 | Demonstrate the use of a lathe and attachments. |
| E | 25.03 | Bore hole with a lathe. |
| E | 25.04 | Drill holes with a lathe. |
| E | 25.05 | Ream holes with a lathe. |
| E | 25.06 | Cut external threads with a lathe. |
| E | 25.07 | Cut internal threads with a lathe. |

NOTE: These skills may be performed in programs having the necessary training facilities; however, ALL students will be able to identify and discuss machine turning operations.

PERFORM MACHINE SHOP TURNING OPERATIONS

25.01 TASK: IDENTIFY THE PRINCIPAL PARTS OF AN ENGINE LATHE.

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, references, and a parts breakdown sheet, identify the principal parts of an engine lathe.

ENABLING OBJECTIVES:

1. Identify an engine lathe.
2. Identify an engine lathe bed.
3. Identify an engine lathe carriage and its parts.
4. Identify an engine lathe head stock and its parts.
5. Identify an engine lathe tail stock and its parts.

25.02 TASK: DEMONSTRATE THE USE OF A LATHE AND ATTACHMENTS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a lathe and attachments, and necessary materials, demonstrate the use of a lathe and attachments.

ENABLING OBJECTIVES:

1. Explain safety precautions when using a lathe.
2. Calculate spindle speeds and cutting speeds.
3. Demonstrate set-up and use of:
 - a. 3-jaw chuck
 - b. 4-jaw chuck
 - c. tail stock attachments for drill and ream.

25.03 TASK: BORE HOLES WITH A LATHE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a lathe, blueprint, workpiece, boring bar, tool blank, boring bar holder, cutting fluid, and precision measuring instruments, bore hole with lathe to a tolerance of + or - .001 inch for location, diameter, depth, and to print surface finish specifications.

ENABLING OBJECTIVES:

1. Explain safety precautions when boring holes with a lathe.
2. Calculate speeds for boring operations on lathes.
3. Describe the procedures for boring holes.
4. Identify the correct cutting fluids for boring.
5. Bore holes with a lathe.

25.04 TASK: DRILL HOLES WITH A LATHE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a lathe, blueprint, workpiece, drill, lathe attachments, and cutting fluid, drill hole in workpiece to a tolerance of + or - .005 inch.

ENABLING OBJECTIVES:

1. Explain safety precautions when drilling with a lathe.
2. Calculate speeds for drilling operations.
3. Describe the procedures for drilling on a lathe.
4. Identify the correct cutting fluid for drilling operations.
5. Drill holes with a lathe.

25.05 TASK: REAM HOLES WITH A LATHE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a lathe, blueprint, workpiece, reamer, lathe attachments, cutting fluid, and inside measuring instruments, ream hole in workpiece to a tolerance of .002, - .000.

ENABLING OBJECTIVES:

1. Explain safety precautions when reaming with a lathe.
2. Calculate speeds for reaming operations.
3. Describe the procedures for reaming.
4. Identify the correct cutting fluid for reaming.
5. Ream holes with a lathe.

25.06 TASK: CUT EXTERNAL THREADS WITH A LATHE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a lathe, blueprint, workpiece, tool holder, tool blank, center gauge, cutting fluids, and precision measuring instruments, cut external threads and in accordance with Machinery's Handbook. Use thread micrometer and/or three wire system for checking threads.

ENABLING OBJECTIVES:

1. Explain safety precautions when cutting threads with a lathe.
2. Explain the formulas used in the three wire system for measuring external threads.
3. Calculate proper speeds for cutting external threads.
4. Describe the procedures for cutting external threads.
5. Select the correct cutting fluid for threading operations.
6. Calculate thread depth.
7. Calculate total in feed of compound.
8. Determine depth per pass.
9. Determine compound off-set angle (right or left hand threads).
10. Cut external threads with a lathe.

25.07 TASK: CUT INTERNAL THREADS WITH A LATHE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a lathe, blueprint, workpiece, tool holder, tool blank, thread center gauge, cutting fluids and precision measuring instruments, cut internal threads on work pieces to class 2 tolerance internal threads in accordance with Machinery's Handbook. Use threaded part or plug gauge for checking threads.

ENABLING OBJECTIVES:

1. **Explain safety precautions when chasing internal threads.**
2. **Calculate total in feed of compound for unified threading.**
3. **Calculate proper speeds and hole size for cutting internal threads.**
4. **Describe the procedures for cutting internal threads.**
5. **Indicate the correct cutting fluid for threading.**
6. **Determine depth of cut per pass.**
7. **Determine compound off-set angle.**
8. **Cut internal threads with a lathe.**

**CURRICULUM GUIDE FOR
INDUSTRIAL MECHANICS**

MODULE 26

**PERFORM MACHINE SHOP MILLING
OPERATIONS**

MODULE 26 - PERFORM MACHINE SHOP MILLING OPERATIONS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 26 - PERFORM MACHINE SHOP MILLING OPERATIONS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 26.01 | Identify types of milling machines and tooling. |
| E | 26.02 | Select and set feeds and speeds for milling work. |
| E | 26.03 | Perform external milling operations. |
| E | 26.04 | Perform angular milling operations. |
| E | 26.05 | Perform internal milling operations. |
| E | 26.06 | Slab mill a workpiece. |
| E | 26.07 | Slot on a horizontal milling machine. |
| E | 26.08 | Mill a keyway. |

NOTE: These skills may be performed in programs having necessary training facilities; however, ALL students will be able to discuss and explain the tasks in this module.

PERFORM MACHINE SHOP MILLING OPERATIONS

26.01 TASK: IDENTIFY TYPES OF MILLING MACHINES AND TOOLING

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, manuals, and references, identify types of milling machines and tooling.

ENABLING OBJECTIVES:

1. **Identify types of milling machines.**
2. **Identify the functional parts of a milling machine.**
3. **Identify common tools used in milling machines.**

26.02 TASK: SELECT AND SET FEEDS AND SPEEDS FOR MILLING WORK

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a milling machine, a variety of materials with a known hardness, and a milling handbook, select and set feeds and speeds for milling each material.

ENABLING OBJECTIVES:

1. **Explain safety precautions when setting up milling work.**
2. **List the cutting speed and feed for the following materials:**
 - a. **Cold rolled steel, with 1/2" end mill**
 - b. **Aluminum, with 1/4" end mill**
 - c. **Tool steel, with 3/8" end mill.**
3. **Select and set feeds and speeds for each of the above materials on a milling machine.**

26.03 TASK: PERFORM EXTERNAL MILLING OPERATIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint, a work-piece holding device, an end mill, cutting fluid, and precision measuring instruments, mill a flat surface to " .001 T.I.R.

ENABLING OBJECTIVES:

1. **Explain safety precautions when performing end milling.**
2. **Calculate speeds, feeds, and depth of cut for an end milling.**
3. **Describe procedures for setting up and end milling a flat surface.**
4. **Select the correct cutting fluid.**
5. **End mill a flat surface to " .001 T.I.R.**

26.04 TASK: PERFORM ANGULAR MILLING OPERATIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint, a milling machine, an indexing head, drills, Machinery's Handbook, a workpiece, cutting fluids, and precision measuring instruments, drill holes in workpiece to specified angles using the indexing head.

ENABLING OBJECTIVES:

1. Explain safety precautions when performing angular milling.
2. Perform calculations for the indexing head when angular indexing.
3. Calculate speeds and feeds for angular indexing operations.
4. Describe procedures for milling holes using angular indexing.
5. Select the correct cutting fluid.
6. Drill holes in a workpiece to specified angles using an indexing head.

26.05 TASK: PERFORM INTERNAL MILLING OPERATIONS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint with bore specifications, a milling machine, a workpiece, a work holding device, a boring head, cutting fluid, and precision measuring instruments, bore a hole in a workpiece within blueprint tolerances.

ENABLING OBJECTIVES:

1. Explain safety precautions when boring and counterboring holes.
2. Explain procedures for accurately adjusting a boring head.
3. Calculate speeds and feeds for boring operations.
4. Describe procedures for set up and boring operations.
5. Select correct cutting fluids for boring and counterboring.
6. Bore a hole in a workpiece using a boring head on a milling machine within blueprint tolerances.

26.06 TASK: SLAB MILL A WORKPIECE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint, a work-piece, a horizontal milling machine, a slab milling cutter, an arbor with spacers, a work holding device, cutting fluids, and precision measuring instruments, slab mill the workpiece. After rough and finish cut, parallelism must be within .002 inch per 6 inches of length.

ENABLING OBJECTIVES:

1. Explain safety precautions when slab milling.
2. Explain the importance of maintaining a clean milling machine.
3. Mount a cutter and arbor in a milling machine.
4. Explain why the cutter should always be mounted on the arbor as close to the column of the milling machine as possible.

5. Describe the correct cutting fluid.
6. Select the correct cutting fluid.
7. Explain the use of climb milling and conventional milling.
8. Mill, rough and finish cut a workpiece to within .002 inches per 6 inches of length.

26.07 TASK: SLOT ON A HORIZONTAL MILLING MACHINE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint, a horizontal milling machine, a cutter, cutting fluids, and precision measuring instruments, slot on a horizontal milling machine within blueprint tolerances.

ENABLING OBJECTIVES:

1. Explain safety precautions when slotting on a horizontal milling machine.
2. Calculate depth and size of slot.
3. Calculate speed and feed for slot.
4. Slot on a horizontal milling machine within blueprint tolerances.

26.08 TASK: MILL A KEYWAY

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a blueprint, a work-piece, a milling cutter, cutting fluid, and precision measuring instruments, mill a keyway within blueprint tolerance.

ENABLING OBJECTIVES:

1. Explain safety precautions when milling a keyway.
2. Describe keyway data in Machinery's Handbook.
3. Calculate depth of a keyway.
4. Calculate speed and feed of machine for keyway.
5. Describe procedure for milling a keyway.
6. Mill a keyway within blueprint tolerances.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 27

ANALYZE MACHINE SHOP JOBS

MODULE 27 - ANALYZE MACHINE SHOP JOBS

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IDAHO CURRICULUM GUIDE FOR INDUSTRIAL MECHANICS

TASK LISTING

MODULE 27 - ANALYZE MACHINE SHOP JOBS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|---|
| E | 27.01 | Determine sequence of work on a specified project. |
| E | 27.02 | Determine tolerances and finishes. |
| E | 27.03 | Explain the variables that affect job efficiency. |
| E | 27.04 | Explain the use of the Machinery Handbook. |

ANALYZE MACHINE SHOP JOBS

27.01 TASK: DETERMINE SEQUENCE OF WORK ON A SPECIFIED PROJECT

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, details of a specific project, and necessary references, determine sequence of work on the project.

ENABLING OBJECTIVES:

1. Describe the planning required to complete a job.
2. Identify the job steps required to complete the project.
3. Outline the sequence of work on the project.

27.02 TASK: DETERMINE TOLERANCES AND FINISHES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a specific project and its blueprint, and necessary references, determine tolerances and finishes for the project.

ENABLING OBJECTIVES:

1. Define tolerance and finish as used in machining.
2. Calculate maximum and minimum tolerance range.
3. Determine finish parameters according to blueprint.

27.03 TASK: EXPLAIN THE VARIABLES THAT AFFECT JOB EFFICIENCY

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, appropriate reference and resource materials, explain the variable that affect job efficiency.

ENABLING OBJECTIVES:

1. Explain the importance of planning machine shop jobs.
2. Explain how to select proper sequence for job steps.
3. Explain how materials, supplies, tools and equipment can affect job efficiency.
4. Explain how attention to process improves job outcome.

27.04 TASK: EXPLAIN THE USE OF THE MACHINERY'S HANDBOOK

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and resource material, explain the use of the Machinery's Handbook.

ENABLING OBJECTIVES:

1. Explain the type of information found in Machinery's Handbook.
2. Explain use of Machinery's Handbook in analyzing machine shop jobs.

CURRICULUM GUIDE FOR

INDUSTRIAL MECHANICS

MODULE 28

**DEMONSTRATE KNOWLEDGE OF
MAINTENANCE MANAGEMENT SYSTEMS**

MODULE 28 - DEMONSTRATE KNOWLEDGE OF MAINTENANCE MANAGEMENT SYSTEMS

This is one of a series of modules which comprise the Idaho Curriculum Guide for Industrial Mechanics. Each module contains a listing of the tasks, performance objectives, and enabling objectives required to enable a student to achieve competency in a specific system or field of study within the industrial mechanics occupational field. The numbering of these modules is not intended to dictate an order of instruction or scheduling. The order in which these modules may be taught is determined by each institution and its instructors.

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TASK LISTING

MODULE 28 - DEMONSTRATE KNOWLEDGE OF MAINTENANCE MANAGEMENT SYSTEMS

The student will be able to:

LEVEL

- | | | |
|----------|--------------|--|
| E | 28.01 | Demonstrate knowledge of manual record keeping practices. |
| E | 28.02 | Demonstrate knowledge of electronic record keeping practices. |
| E | 28.03 | Complete a work order. |
| E | 28.04 | Complete an internal requisition. |
| E | 28.05 | Complete an external requisition. |
| E | 28.06 | Use a microfiche record system. |
| E | 28.07 | Define and explain scheduled maintenance. |
| E | 28.08 | Define and explain planned maintenance. |
| E | 28.09 | Define and explain breakdown maintenance. |
| E | 28.10 | Explain the reasons for keeping maintenance records. |
| E | 28.11 | Explain the reasons for keeping cost records. |
| E | 28.12 | Demonstrate basic computer literacy. |
| E | 28.13 | Define statistical process control (SPC). |

DEMONSTRATE KNOWLEDGE OF MAINTENANCE MANAGEMENT SYSTEMS

28.01 TASK: DEMONSTRATE KNOWLEDGE OF MANUAL RECORD KEEPING PRACTICES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and manual record keeping systems to study, demonstrate knowledge of manual record keeping practices.

ENABLING OBJECTIVES:

1. **Identify the manual record keeping system used.**
2. **Explain the order in which the system works.**
3. **Demonstrate use of a manual record keeping system.**
4. **Explain the benefits of a manual record keeping system.**

28.02 TASK: DEMONSTRATE KNOWLEDGE OF ELECTRONIC RECORD KEEPING PRACTICES

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, and an electronic record keeping system to study, demonstrate knowledge of electronic record keeping practices.

ENABLING OBJECTIVES:

1. **Identify the electronic record keeping system used.**
2. **Explain the order in which the electronic record system works.**
3. **Demonstrate the use of an electronic record keeping system.**
4. **Explain the benefits of an electronic record keeping system.**

28.03 TASK: COMPLETE A WORK ORDER

LEVEL E **PERFORMANCE OBJECTIVE:** Given instructions, a job, and a shop work order form, complete a work order to manufacturing standards.

ENABLING OBJECTIVES:

1. **Explain the use of a shop work order in industry.**
2. **Discuss the importance of the correct and legible preparation of a shop work order.**
3. **Identify the necessary information required on a shop work order.**
4. **Complete a shop work order to acceptable industry standards.**

28.04 TASK: COMPLETE AN INTERNAL REQUISITION

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a specific requirement, and a internal requisition form, complete an internal requisition.

ENABLING OBJECTIVES:

1. Explain the use of an internal requisition in industry.
2. Discuss the importance of the correct and legible preparation of an internal requisition.
3. Identify the necessary information required on an internal requisition.
4. Complete an internal requisition to acceptable industry standards.

28.05 TASK: COMPLETE AN EXTERNAL REQUISITION

LEVEL E PERFORMANCE OBJECTIVE: Given instructions, a specific requirement, and a external requisition form, complete an external requisition.

ENABLING OBJECTIVES:

1. Explain the use of an external requisition in industry.
2. Discuss the importance of the correct and legible preparation of an external requisition.
3. Identify the necessary information required on an external requisition.
4. Complete an internal requisition to acceptable industry standards.

28.06 TASK: USE A MICROFICHE RECORD SYSTEM

LEVEL E PERFORMANCE OBJECTIVE: Given instructions, a microfiche viewer, microfiche, and microfiche record system information, use a microfiche record system.

ENABLING OBJECTIVES:

1. Identify the microfiche record system.
2. Explain the benefits of microfiche systems.
3. Explain the locator system for finding records.
4. Demonstrate the use of the microfiche viewer to locate a record.
5. Compile information from microfiche records.

28.07 TASK: DEFINE AND EXPLAIN SCHEDULED MAINTENANCE

LEVEL E PERFORMANCE OBJECTIVE: Given instruction, a scheduled maintenance system, and necessary references, define and explain scheduled maintenance.

ENABLING OBJECTIVES:

1. Define scheduled maintenance.
2. Explain the importance of scheduled maintenance.

3. Identify the scheduled maintenance system used.
4. Explain service change intervals.

28.08 TASK: DEFINE AND EXPLAIN PLANNED MAINTENANCE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a planned maintenance system, and necessary references, define and explain planned maintenance.

ENABLING OBJECTIVES:

1. Define planned maintenance.
2. Explain the importance of planned maintenance.
3. Identify the planned maintenance change intervals.
4. Explain planned maintenance change intervals.

28.09 TASK: DEFINE AND EXPLAIN BREAKDOWN MAINTENANCE

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a breakdown maintenance system, and necessary references, define and explain breakdown maintenance.

ENABLING OBJECTIVES:

1. Define breakdown maintenance.
2. Explain procedure for replacing a unit during breakdown.
3. Define cost factor.
4. Explain the cost factor in breakdown maintenance.

28.10 TASK: EXPLAIN THE REASONS FOR KEEPING MAINTENANCE RECORDS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, an example of maintenance record keeping, and necessary references, explain the reasons for keeping maintenance records.

ENABLING OBJECTIVES:

1. Describe the importance of maintenance records.
2. Identify maintenance record contents.
3. Explain maintenance record keeping benefits.

28.11 TASK: EXPLAIN THE REASONS FOR KEEPING COST RECORDS

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, a cost recording system, and necessary references, explain the reasons for keeping cost records.

ENABLING OBJECTIVES:

1. Describe the importance of cost records.

2. Identify cost record contents.
3. Explain cost record keeping system benefits.

28.12 TASK: DEMONSTRATE BASIC COMPUTER LITERACY

LEVEL E **PERFORMANCE OBJECTIVE:** Given computer instruction, a personal computer, disk operating system (DOS) software, and applications software, demonstrate basic computer literacy.

ENABLING OBJECTIVES:

1. Discuss basic computer terminology.
2. Identify major computer hardware components.
3. Explain use of each hardware component.
4. Identify the disk operating system (DOS) software.
5. Explain use of DOS in operating the computer.
6. Demonstrate personal computer start up procedures.
7. Identify three basic types of software programs: spreadsheet, data base, and word processing.
8. Explain uses of a spreadsheet, data base, and word processing program in industry.
9. Explain procedure for loading a software program.

28.13 TASK: DEFINE STATISTICAL PROCESS CONTROL (SPC)

LEVEL E **PERFORMANCE OBJECTIVE:** Given instruction, reference materials and manuals, define statistical process control.

ENABLING OBJECTIVES:

1. Describe a typical statistical process control system.
2. Explain reasons for using statistical process control in production operations.
3. Discuss benefits of statistical process control to the manufacturer and the customer.
4. Discuss the expected results of a statistical process control program.